



# **Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Academic Year - 2023-24**

## **Syllabus Under CBCS**

**Post Graduate Program in  
Computer Science**

**Department of Computer Science**

**M. Sc. (Computer Science) SY**

**Syllabi Approved by the Board of Studies in  
Computer Science with effect from June, 2023**

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**Curriculum Structure with effect from June, 2023**  
**M. Sc. (Computer Science) Second Year**  
**Semester III**

	Course Code	Course Title	Lectures		Marks		Credits	
			Per week	Total	C.C.E.	E.S.E		
<b>Semester - III</b>	P-WPD-328	Web Development using PHP	4	60	40	60	4	
	P-LIA-329	LINUX Administration	4	60	40	60	4	
	P-SOE-330	Software Engineering	4	60	40	60	4	
	<b>Choose any one from the following Elective Courses</b>							
	P-DIP-331-I	Digital Image Processing	4	60	40	60	4	
	P-COG-331-II	Computer Graphics	4	60	40	60	4	
	P-ARI-331-III	Artificial Intelligence	4	60	40	60	4	
	<b>Practical Courses</b>							
	P-LAC-332	Lab-Course V	3	30	20	30	2	
	P-LAC-333	Lab-Course VI	3	30	20	30	2	
	P-LAC-334	Lab-Course VII	3	30	20	30	2	
	P-LAC-335	Lab-Course VIII	2	30	20	30	2	
	P-SEM-383	Seminar - III	--	--	25	--	1	
		<b>Total</b>			<b>625</b>		<b>25</b>	

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**Curriculum Structure with effect from June, 2023**  
**M. Sc. (Computer Science) Second Year**  
**Semester IV**

	Course Code	Course Title	Lectures		Marks		Credits	
			Per week	Total	C.C.E.	E.S.E		
<b>Semester - IV</b>	P-BIA-426	Big Data Analysis	4	60	40	60	4	
	P-AJP-427	Advanced Java Programming	4	60	40	60	4	
	P-CLC-428	Cloud Computing	4	60	40	60	4	
	<b>Choose any one from the following Elective Courses</b>							
	P-INS-429-I	Information Security	4	60	40	60	4	
	P-SOC-429-II	Soft Computing	4	60	40	60	4	
	P-PAR- 429-III	Pattern Recognition	4	60	40	60	4	
	<b>Practical Courses</b>							
	P-LAC-430	Lab-Course VIII	3	30	20	30	2	
	P-LAC-431	Lab-Course IX	3	30	20	30	2	
		Project	3	30	40	60	4	
	P-SEM-477	Seminar – IV	--	--	25	--	1	
		<b>Total</b>			<b>625</b>		<b>25</b>	

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester III**

**Course Title: Web Development Using PHP**

**Course Code: P-WPD-328**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- To train the students in creating dynamic web pages using PHP
- Inculcate Core-PHP, Server-Side Scripting Language
- Demonstrate PHP-Database handling.
- One PHP frame work for effective design of web application.
- To make the students create web pages using Java-Script, CSS, MVC.
- To familiarize students with AJAX and Bootstrap.

**Course Outcomes:** After completion of this course students will be able to:

- Develop web pages using HTML, CSS and JavaScript
- Build web applications using PHP and MySQL database
- Discuss the integration of PHP with AJAX & BootStrap
- Create and deploy a portable web-based system
- Test and debug object-oriented PHP scripts

<b>Unit No.</b>	<b>Contents</b>	<b>No. of Lect.</b>
<b>UNIT I: Introduction to PHP, Function and Arrays</b>	Introduction to web techniques Introduction to PHP, what does PHP do? History of PHP, Installing PHP 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. Arrays: Indexed Vs Associative arrays, identifying elements of an array, storing data in arrays, Multidimensional arrays, extracting multiple values, Converting between arrays and variables, Traversing Arrays, Sorting.	<b>10</b>
<b>UNIT II: Working with Data, Objects &amp; Bootstrap</b>	<b>Working with Data:</b> 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. <b>Introduction to Object Oriented Programming:</b> Classes, Objects, Serialization, Inheritance Interfaces, Encapsulation. <b>Introduction to Bootstrap:</b> Where to get Bootstrap 4? Bootstrap containers, Grids, Tables, Images, Alerts, dropdown, Accoordian, Tabs&Pills, Navigation Bar, Buttons, ProgressBar, Pagination.	<b>15</b>

Unit No.	Contents	No. of Lect.
<b>UNIT III: Web Techniques and MYSQL</b>	<p><b>Cookies &amp; Sessions</b> 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.</p> <p><b>Manipulating MySQL data with PHP-</b> Inserting, updating, deleting records. Building a member registration application, Creating a members area, creating a member manager application.</p> <p><b>PHP framework and Handling email with php</b> Introduction to PHP framework, Features, Applications, One example like CodeIgniter Sending email with php, Email id validation and verification.</p>	<b>20</b>
<b>UNIT IV: Web Designing Technologies and Ajax</b>	<p>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.</p> <p>Introduction to AJAX Introduction of AJAX, Simple AJAX Example, Performing simple AJAX validation.</p>	<b>15</b>

**REFERENCE BOOKS:**

1. Programming PHP , Rasmus Lerdrof and Kevin Tatroe, O'Reilly publication
2. Beginning PHP 5.3, Matt Doyle, Wrox Publication
3. AJAX Black Book, Kogent Solution

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester III**  
**Course Title: Linux Administration**

**Course Code: P-LIA-329**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- To familiarize students with the Linux environment
- To enable the students work with various basic LINUX commands
- To learn the fundamentals of shell scripting/programming
- To familiarize students with basic Linux administration

**Course Outcomes:** After completion of this course students will be able to:

- Work confidently in Unix/Linux environment.
- Make use of various commands in LINUX to control various resources like file, network, disk etc
- Develop Shell Script using Shell commands.
- Master the basics of Linux administration.

Unit No.	Contents	No. of Lect.
<b>UNIT I Introduction to Linux and Linux Files and Directories</b>	Introducing Linux, Installing Red Hat Linux, Features of Linux, Basic Architecture of Linux system, features of Kernel and Shell. Boot block, Superblock and Data blocks, How Unix/Linux kernel access files. The shell Scripts, 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 ln Archiving and compressing files, Filters and pipes: head, tail, wc, pr, cut, paste, sort, uniq, grep, egrep, fgrep, tee	<b>15</b>
<b>UNIT II Managing Users and File system</b>	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. Mounting File Systems automatically:/etc/fstab. 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 File System.	<b>15</b>

Unit No.	Contents	No. of Lect.
<b>UNIT III Backing Up, Recovery and Printing with Linux</b>	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	<b>15</b>
<b>UNIT IV Network Connectivity and Managing DNS</b>	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.	<b>15</b>

**REFERENCE BOOKS:**

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

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester III**

**Course Title: Software Engineering**

**Course Code: P-SOE-330**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- To impart the knowledge on the Software Engineering Principles, Applications and Process models.
- To help the students to learn the Requirement Engineering Process.
- To create awareness on the basic activities of software project management.
- To provide the idea of decomposing the given problem into Analysis, Design, implementation, Testing and Maintenance phases.
- To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.

**Course Outcomes:** After completion of this course students will be able to:

- Demonstrate an understanding of the key facts, concepts, principles and theories of software engineering
- Analyze the effective software engineering process, based on knowledge of widely used development lifecycle models.
- choose appropriate process model depending on the user requirements.
- perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
- apply the knowledge, techniques, and skills in the development of a software product.

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>Unit 1: Introduction and Software Metrics</b>	Software, Software Characteristics, Software Components, Software Applications, Software: A Crisis on The Horizon, The Software Process, Software Process Models: The Linear Sequential Model, The Prototyping Model, Evolutionary Software Process Models: The Incremental Model, The Spiral Model, Software Project Management: People, The Problem, The Process Measures, Metrics, Indicators, Software Measurement: Size -Oriented Metrics, Function-Oriented Metrics.	<b>15</b>
<b>Unit 2: Software Project Planning and Risk Management</b>	Project Planning Objectives, Software Scope, Resources, Software Project Estimation, Empirical Estimation Models: The Structure of Estimation Models, COCOMO Model, The Software Equation, Software Risks, Risk Identification: Product Size, Business Impact, Customer Characteristics, Process Definition, Development Environment, Technology to Be Built, Staff Size and Experience, RMMM Plan, Software Scheduling: Timeline Chart, Tracking the Schedule, The Project Plan.	<b>15</b>



<b>Unit No.</b>	<b>Contents</b>	<b>No. of Lect.</b>
<b>Unit 3: Software Quality Assurance and Configuration Management</b>	Quality Concepts: Quality, Quality Control, Quality Assurance, Cost of Quality, Formal Technical Reviews: The Review Meeting, Review Reporting and Record Keeping, Review Guidelines, SQA Plan, The Iso 9000 Quality Standards, Software Configuration Management: Baseline, Software Configuration Items, The Design Process.	<b>15</b>
<b>Unit 4: Types and Levels of Testing</b>	White box testing, Black box testing, Levels of testing, Unit testing, Integration testing, Testing web application, Acceptance testing, GUI testing, Regression testing, Manual testing, Automated testing.	<b>15</b>

**Reference Books:**

1. Software Engineering A Practitioner's Approach Fourth Edition, Roger S. Pressman, Ph.D.
2. Software testing Principles & Practices, Naresh Chauhan, Oxford University Press.
- 3.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester III**

**Course Title: Digital Image Processing**

**Course Code: P-DIP-331-I**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- To familiarize students with digital image fundamentals.
- To discuss the properties of digital image.
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn image degradation and restoration techniques.
- To study the Morphological Image Processing and Image Segmentation

**Course Outcomes:** After completion of this course students will be able to:

- After completion of this course, students should be able to:
- Know and understand the fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the image enhancement and Filtering Methods.
- Understand the image degradation and restoration
- perform operations on color images
- apply the morphological operation and segmentation techniques on images.
- Perform color image processing Operations

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>Unit- I Introduction to Image Processing and M Function Programming</b>	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, neighbors of pixels, distance. Representing digital images. 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.	<b>15</b>

Unit No	Contents	No of Lectures
<b>Unit- II Intensity Transformations and Filtering</b>	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.	<b>15</b>
<b>Unit - III Image Restoration and Color Image Processing</b>	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 HSI Color Space, The Basics of Color Image Processing, color Transformations, Spatial Filtering of Color Images and working directly in RGB vector space.	<b>15</b>
<b>UNIT IV Morphological Image Processing and Image Segmentation</b>	Erosion and Dilation, Opening and Closing, The Hit or Miss Transformations, Basic Morphological algorithms, Edge Detection, Thresholding, Region based Segmentation, Segmentation using Morphological Watersheds and the use of motion in Segmentation.	<b>15</b>

**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, Pearson Education
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Prentice Hall.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester III**  
**Course Title: Computer Graphics**

**Course Code: P-COG-331-II**  
**Total Lectures: 60**

**Credits: 4**  
**Max. Marks: 100**

**Learning Objectives:**

- To discuss the basic principles of computer graphics prim
- To learn various computer graphics hardware and display technologies.
- To learn the fundamentals of 2D and 3D graphics pipeline, 2D and 3D transformations.
- To learn the line drawing and curve generation algorithms.
- To get familiar with fundamental color models.

**Course Outcomes:**

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

- Understand the various computer graphics hardware and display technologies.
- Understand various 2D and 3D objects transformation techniques.
- Understand line drawing and curve generation.
- Understand color models

Unit No	Contents	No of Lectures
<b>Unit I Introduction to Computer Graphics</b>	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 Bransenham'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.	<b>15</b>
<b>Unit II Transformation and Clipping</b>	Two-dimensional geometric Transformation: Basic 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-Hodgeman Algorithm).	<b>15</b>

Unit No.	Contents	No. of Lect.
<b>Unit III Three-Dimensional Graphics</b>	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.	<b>15</b>
<b>Unit IV Illumination and Color Models</b>	<b>Visible Surface Detection Methods:</b> Classification of Visible-Surface Detection Algorithms, Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan line and Depth Sorting, <b>Illumination Models and Surface-Rendering Methods:</b> Basic Illumination Models, Displaying Light Intensities, Halftone Patterns and Dithering Techniques, <b>Polygon-</b> Rendering Methods (Ground Shading, Phong Shading), Light sources – basic illumination models – half tone patterns and dithering techniques. <b>Intuitive colour concepts</b> – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.	<b>15</b>

**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.
5. Introduction to Computer Graphics by Godse

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester III**  
**Course Title: Artificial Intelligence**

**Course Code: P-ARI-331-III**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

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**Learning Objectives:**

The objective of this course is to

- To enable students to differentiate optimal reasoning vs human like reasoning.
- To make the students aware of AI problem solving techniques.
- To discuss with students about the propositional logic.
- To facilitate the students to study various learning models.

**Course Outcomes:** After completion of this course students will be able to:

- Describe the fundamentals of Artificial Intelligence and its applications.
- Apply various logical systems to inference the different logical problems.
- Identify the machine learning techniques.
- understand the principles of problem solving and be able to apply them successfully.

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>UNIT-I Fundamentals of Artificial Intelligence</b>	Introduction, A.I. Representation, Non-AI & AI Techniques, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Architecture of Intelligence Agents. Computer vision, Natural Language Processing.	<b>10</b>
<b>UNIT-II Problem Solving Methods and Knowledge Representation &amp; Reasoning</b>	<b>Problem Solving Methods</b> Problem Solving Methods, Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Heuristics, Alpha – Beta pruning. <b>Knowledge Representation &amp; Reasoning</b> Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.	<b>20</b>
<b>UNIT-III Machine Learning</b>	Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data – Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning.	<b>15</b>

Unit No.	Contents	No. of Lect.
<b>UNIT-IV Pattern Recognition</b>	Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods – Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.	<b>15</b>

**REFERENCE BOOKS:**

1. Artificial Intelligence by Puntambekar, Tech Max Publication
2. Artificial Intelligence: A Modern Approach by Russell, Pearson Education Publication
3. Artificial Intelligence: A New Synthesis by Nilsson, Asia PTE Ltd Publication
4. Introduction To Artificial Intelligence & Expert Systems by Patterson, PHI Education Publication
5. A First Course in Artificial Intelligence by Deepak Khemani, MC Graw Hill Publication

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester III**

**Course Title: Web Development Using PHP (Lab-Course V)**

**Course Code: P-LAC-332**

**Credits: 2**

**Total Lectures: 60**

**Max. Marks: 50**

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**Learning Objectives:**

- To train the students in creating dynamic web pages using PHP
- Inculcate Core-PHP, Server-Side Scripting Language
- Demonstrate PHP-Database handling.
- One PHP frame work for effective design of web application.
- To make the students create web pages using Java-Script, CSS, MVC .
- To familiarize students with AJAX and Bootstrap.

**Course Outcomes:** After completion of this course students will be able to:

- Develop web pages using HTML, CSS and JavaScript
- Build web applications using PHP and MySQL database
- Discuss the integration of PHP with AJAX & BootStrap
- Create and deploy a portable web-based system
- Test and debug object-oriented PHP script.

**LIST OF PRACTICAL**

1. Write a Program for
  - a. Print "Hello World" 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. Write a program for tables using Bootstrap.
10. Write a program for different styles of buttons using Bootstrap.
11. Write a program for different progress bar using Bootstrap.
12. Write a program for dropdowns using Bootstrap.
13. Write a program for navbar using Bootstrap.
14. Working with MySQL Commands Like DML, DDL
15. Write a Program for Data base connectivity in PHP
16. Write a Program for
  - a. Printing "HelloWorld" in JavaScript
  - b. Working with variables in JavaScript
  - c. Working with Control Statements in JavaScript
17. Write a Program for
  - a. JavaScript Functions
  - b. JavaScript Pop up Boxes
18. Working with Form and validating the forms in PHP
19. Working with Advance CSS.
20. Mini Project

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester III**

**Course Title: Linux Administration (Lab-Course VI)**

**Course Code: P-LAC-333**

**Credits: 2**

**Total Lectures: 60**

**Max. Marks: 50**

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**Learning Objectives:**

- To familiarize students with the Linux environment
- To enable the students work with various basic LINUX commands
- To learn the fundamentals of shell scripting/programming
- To familiarize students with basic Linux administration

**Course Outcomes:** After completion of this course students will be able to:

- Work confidently in Unix/Linux environment.
- Make use of various commands in LINUX to control various resources like file, network, disk etc
- Develop Shell Script using Shell commands.
- Master the basics of Linux administration

**LIST OF PRACTICALS**

1. Installation steps of Linux OS.
2. File related commands in Linux
3. Directory related commands in Linux
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 Programs)

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester III**

**Course Title: Digital Image Processing (Lab-Course VII)**

**Course Code: P-LAC-334**

**Credits: 2**

**Total Lectures: 60**

**Max. Marks: 50**

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**Learning Objectives:**

- To familiarize students with digital image fundamentals.
- To discuss the properties of digital image.
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn image degradation and restoration techniques.
- To study the Morphological Image Processing and Image Segmentation

**Course Outcomes:** After completion of this course students will be able to:

- After completion of this course, students should be able to:
- Know and understand the fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the image enhancement and Filtering Methods.
- Understand the image degradation and restoration
- perform operations on color images
- apply the morphological operation and segmentation techniques on images.
- Perform color image processing Operation

**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 in 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. Program to demonstrate Morphological Image Processing Operations
14. Program to demonstrate image segmentation techniques.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester IV**  
**Course Title: Big Data Analysis**

**Course Code: P-BIA-426**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- This course provides an overview of approaches facilitating data analytics on huge datasets.
- To Implement clustering, regression, association rules, and decision trees for data analysis and prediction.
- To assess realistic application of big data analytics technologies for different usage scenarios and start with their own experiments.

**Course Outcomes:** After completion of this course students will be able to:

- Understand the concept and challenge of bigdata and why existing technology is inadequate to analyze the bigdata
- Collect, manage, store, query, and analyze various form of big data;
- Gain hands-on experience on large-scale analytics tools to solve some big data problems;
- Understand the impact of big data for business decisions and strategy.

Unit No	Contents	No of Lectures
<b>Unit I: Introduction to Big Data Analytics &amp; Data Analytics Lifecycle</b>	Big Data Overview, Data Structures, Analyst Perspective on Data Repositories, State of the Practice in Analytics, BI 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. 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.	<b>20</b>

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>Unit- II: Review of Basic Data Analytic Methods Using R</b>	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.	<b>10</b>
<b>Unit III: Advanced Analytical Theory and Methods: Clustering &amp; Decision Trees</b>	Overview of Clustering, K-means, Use Cases, Overview of the Method, Determining the Number of Clusters, Diagnostics, Contents, Reasons to Choose and Cautions. Decision Trees: Overview of a Decision Tree, Decision tree Algorithms, Decision Trees in R, Naïve Bayes, Naïve Bayes in R	<b>15</b>
<b>Unit IV: Advanced Analytical Theory and Methods: Association Rules and Regression</b>	Overview of Association, Evaluation of Candidate rules, Applications of Association Rules, An Example: Transaction in a Grocery Store, Validations & testing. Linear Regression: Use cases, model description, and diagnostics. Logistic Regression: Use cases, model description, and diagnostics. Reasons to choose & cautions.	<b>15</b>

**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

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester IV**

**Course Title: Advanced Java Programming**

**Course Code: P-AJP-427**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- Learning basic of Java programming, and OOP's concepts.
- Understand Threads, Packages, and handling runtime errors.
- Inculcate knowledge of developing GUI applications using Swing, & AWT components.
- Learning event handling paradigm, interaction with back-end databases.
- Learn to Create Web Applications using Java.

**Course Outcomes:** After completion of this course students will be able to:

- Write, compile and execute simple Java programs.
- Solve complex problems using the concepts of class, inheritance, interface and packages.
- Test for runtime exceptions arise in java applications.
- Make use of threads to create multithreaded java applications.
- Design graphical application, work with events.
- Interact with database with JDBC , Develop web-based applications.

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>Unit-I Introduction and Object-Oriented Programming</b>	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 Methods, Argument Passing Mechanism, Method Overloading, Recursion, Dealing with Static Members, Finalize() Method, Native Method.	<b>15</b>

Unit No	Contents	No of Lectures
<b>Unit II Extending Classes Inheritance and Packages</b>	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.	<b>15</b>
<b>Unit III Exception Handling, Thread and GUI Programming Exception Handling</b>	<p>The Idea behind Exception, Exceptions &amp; 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.</p> <p><b>Thread:</b> Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Critical Factor in Thread –Dead Locks.</p> <p><b>GUI Programming:</b> 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 &amp; Vector.</p>	<b>15</b>
<b>Unit IV Event Handling, JDBC and Servlets</b>	<p><b>Event Handling</b> 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.</p> <p><b>Database Programming using JDBC</b> Introduction to JDBC, JDBC Drivers &amp; Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.</p> <p><b>Java Server Technologies Servlet</b> 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.</p>	<b>15</b>

**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

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester IV**  
**Course Title: Cloud Computing**

**Course Code: P-CLC-428**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- Learn fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges.
- Comprehend basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations.
- Inculcate Cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;

**Course Outcomes:** After completion of this course students will be able to:

- Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.
- Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.
- Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.
- Analyze various cloud programming models and apply them to solve problems on the cloud.

Unit No	Contents	No of Lectures
<b>UNIT I: Enterprise computing: a retrospective And Internet as a Platform</b>	Introduction, Mainframe architecture, Client-server architecture, 3-tier architectures with TP monitors <b>Internet technology</b> and web-enabled applications Web application servers Internet of services	<b>15</b>
<b>UNIT II: Software as a service and Cloud computing platforms</b>	<b>Emergence of software as a service:</b> Successful SaaS architectures, Dev 2.0 platforms, Cloud computing <b>Infrastructure as a service:</b> Amazon EC2, <b>Platform as a service:</b> Google App Engine Microsoft Azure	<b>15</b>
<b>UNIT III: Web Services , AJAX and Mashups</b>	Web Services: SOAP and REST SOAP Vs REST, AJAX: Asynchronous 'rich' interfaces Mashups: user interface services	<b>15</b>



Unit No	Contents	No of Lectures
<b>UNIT IV: Data In Cloud and MapReduce and Extension</b>	Relational Databases, Cloud File systems; GFS and HDFS, BigTable, HBase, and Dynamo, Cloud data stores: Datastore, SimpleDB, Parallel Computing, The MapReduce Model. Parallel efficiency and MapReduce Enterprises batch processing using MapReduce	<b>115</b>

**REFERENCE BOOKS:**

1. Enterprise Cloud Computing: Technology, Architecture, Applications – Gautam Shroff. Cambridge University Press
2. Cloud Computing A Practical Approach- AnthonyT. Velte, Toby J. Velte, Robert Elsenpeter . McGraw Hill Education (India) Pvt Ltd.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester IV**  
**Course Title: Information Security**

**Course Code: P-INS-429-I**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- To identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
- To encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms.
- To analyze existing authentication and key agreement protocols, identify the weaknesses of the se protocols.
- To download and install an e-mail and file security software, PGP, and efficiently use the code to encrypt and sign messages.

**Course Outcomes:** After completion of this course students will be able to:

- Define what information is?
- Appreciate the value of information to the modern organization
- Understand the CIA Triad 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.

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>UNIT I Introduction</b>	What is Information Security & Why do you need it? –Basics Principles of Confidentiality, Integrity Availability Concepts Policies, procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology	<b>15</b>
<b>UNIT II Current Trends in information Security</b>	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	<b>15</b>
<b>UNIT III Threat and Risk</b>	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	<b>12</b>

Unit No	Contents	No of Lectures
<b>UNIT IV assessments for Information Security</b>	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	<b>18</b>

**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

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester IV**  
**Course Title: Soft Computing**

**Course Code: P-INS-429-II**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

- To understanding principles of neural networks and Fuzzy Logic fundamentals.
- To enable the students, know the applications of Neural Networks.
- To understand various learning algorithms in Artificial Neural Network
- To understand operations of Fuzzy Logic
- To understand the application of Artificial Neural Network & Fuzzy Logic

**Course Outcomes:** After completion of this course students will be able to:

- Identify the fundamentals and types of neural networks
- 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.

Unit No	Contents	No of Lectures
<b>UNIT I: Introduction to Fuzzy Logic</b>	Crisp Sets: An Overview, Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts, Membership Functions, 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, Fuzzy Max-Min and Max-product composition.	<b>15</b>
<b>UNIT II Introduction to Neural Networks</b>	Introduction to Neural Networks Biological Neuron and their Artificial Neuron, McCulloch-Pits Neuron Model, Perceptron Classification, Linearly Separability, NOR Problem, Overview of Neural Network Architecture, Learning Rules-Supervised Learning- Unsupervised Learning- Perceptron Learning-Reinforcement Learning-Delta Learning Rule, Hebbian Learning	<b>15</b>
<b>UNIT III: Multilayer Feed Forward Network</b>	Multilayer Feed forward Network, Error CorrectioN Gradient Descent Rule, 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, ADALINE and MADALINE Model	<b>15</b>

Unit No	Contents	No of Lectures
<b>UNIT IV: Recurrent Network and Neuro Fuzzy System</b>	Recurrent Network, Hopfield Network, Counter propagation networks, Boltzmann Machine, Adaptive Resonance theory (ART). Fuzzy System, Neuro Fuzzy System and Applications, Fuzzification & Defuzzification, Fuzzy neurons, Fuzzy Neural Network, Fuzzy associative memory, Application in Pattern Recognition- Image Data Processing, Character, Face, Finger, Palm, Iris Recognition, Application in Expert System	<b>15</b>

**REFERENCE BOOKS:**

1. Fuzzy Sets, Uncertainty, and Information, George J Klir & Tina A Folger (PHI Learning Pvt Ltd)
2. Introduction to Artificial Neural Network by Jaeck M. Zurada, Jaico publishing house
3. Neural Network Algorithms, Applications, and Programming Techniques- James A Freeman/ David M Skapura (Pearson Education Asia)
4. Understanding Neural Network & Fuzzy Logic Basic Concepts & Applications, Stamatios V Kartalopoulos (Author) (PHI Pvt Ltd)

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester IV**  
**Course Title: Pattern Recognition**

**Course Code: P-INS-429-III**

**Credits: 4**

**Total Lectures: 60**

**Max. Marks: 100**

**Learning Objectives:**

The objective of this course is to

- To impart the knowledge on machine learning concepts and artificial intelligence.
- To nurture the students with the principles on probability in pattern matching arena.
- To demonstrate the ideas of Supervised and Unsupervised learning with reference to clustering.
- To make the students learn the precepts of Hidden Markov Models and the usage of Decision trees

**Course Outcomes:** After completion of this course students will be able to:

- Interpret the fundamental concepts of machine perception and Bayesian decision theory in machine learning.
- Inspect parameter estimation in relatively complex probabilistic models using Maximum likelihood and Bayesian approaches.
- Apply unsupervised and supervised learning in simple pattern matching problems.
- Summarize the principles of pattern recognition using Hidden Markov Models.

<b>Unit No</b>	<b>Contents</b>	<b>No of Lectures</b>
<b>Unit-I Pattern Recognition Overview</b>	Definition of Pattern Recognition, Components of pattern Recognition, Different types of Pattern Recognition, Design Principles, Approaches of Pattern Recognition System, Training and Learning in pattern recognition system, Patterns and Features Extraction, Application of Pattern Recognition.	<b>15</b>
<b>Unit-II Statistical Pattern Recognition</b>	Parametric Estimation and supervised learning, Maximum likelihood estimation, Bayesian parameter estimation, Non parametric approaches- Parzen window, KNN estimation, Unsupervised learning- Clustering Concept, Mathematical foundation-Linear Algebra, Probability Theory, Chi Squared Test, Comparison Supervised and Unsupervised Pattern Recognition.	<b>20</b>
<b>Unit-III Syntactic Pattern Recognition</b>	Grammar Based Approaches, Elements of Formal Grammars, Parsing Concepts-Parsing Algorithm, Transition Network in Parsing, Higher Dimensional Grammars, Stochastic Grammars, Grammars, Graphical Approaches- Graph Isomorphism, Attributed Graphs, Hidden Markov Model in Pattern Recognition, Forward Algorithm in HMM (Hidden Markov Model).	<b>15</b>

Unit No	Contents	No of Lectures
<b>Unit-IV Principal Component Analysis in Pattern Recognition</b>	Non-metric methods for pattern classification, Non-numeric data or nominal data, Decision trees, Unsupervised learning and clustering, Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation, K-Nearest Neighbor method, Implementation issues in algorithms for clustering.	<b>10</b>

**Text Books:**

1. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

**Reference Books:**

1. Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.
2. Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press, 2009

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester IV**

**Course Title: Big Data Analysis (Lab-Course VIII)**

**Course Code: P-LAC-430**

**Credits: 2**

**Total Lectures: 30**

**Max. Marks: 50**

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**Learning Objectives:**

- This course provides an overview of approaches facilitating data analytics on huge datasets.
- To Implement clustering, regression, association rules, and decision trees for data analysis and prediction.
- To assess realistic application of big data analytics technologies for different usage scenarios and start with their own experiments.

**Course Outcomes:** After completion of this course students will be able to:

- Understand the concept and challenge of bigdata and why existing technology is inadequate to analyze the bigdata
- Collect, manage, store, query, and analyze various form of big data;
- Gain hands-on experience on large-scale analytics tools to solve some big data problems;
- Understand the impact of big data 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. Hypothesis Testing
  - 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 of association rules in R



**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**

**Department of Computer Science**

**M. Sc. (Computer Science) Second Year Semester IV**

**Course Title: Advanced Java Programming**

**Course Code: P-LAC-431      Lab-Course IX**

**Credits: 2**

**Total Lectures: 30**

**Max. Marks: 50**

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**Learning Objectives:**

- Learning basic of Java programming, and OOP's concepts.
- Understand Threads, Packages, and handling runtime errors.
- Inculcate knowledge of developing GUI applications using Swing, & AWT components.
- Learning event handling paradigm, interaction with back-end databases
- Learn to Create Web Applications using Java.

**Course Outcomes:** After completion of this course students will be able to:

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

**List of Practical**

1. Write a java program to check whether 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.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur**  
**Department of Computer Science**  
**M. Sc. (Computer Science) Second Year Semester IV**  
**Course Title: Soft Computing**

**Course Code: P-INS-429-II**

**Credits: 2**

**Total Lectures: 30**

**Max. Marks: 50**

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**Learning Objectives:**

- To understanding principles of neural networks and Fuzzy Logic fundamentals.
- To understand various learning algorithms in Artificial Neural Network
- To understand operations of Fuzzy Logic
- To understand the application of Artificial Neural Network & Fuzzy Logic

**Course Outcomes:** After completion of this course students will 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  $A \cap B'$ ,  $A' \cap B$ ,  $A \cup B'$ ,  $A' \cup B$  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.