

DR BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE

**Dr. Babasaheb Ambedkar Technological University (Established as a
University of Technology in the State of Maharashtra)**

(Under Maharashtra Act No. XXIX of 2014)

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PROPOSED CURRICULUM UNDER GRADUATE PROGRAMME

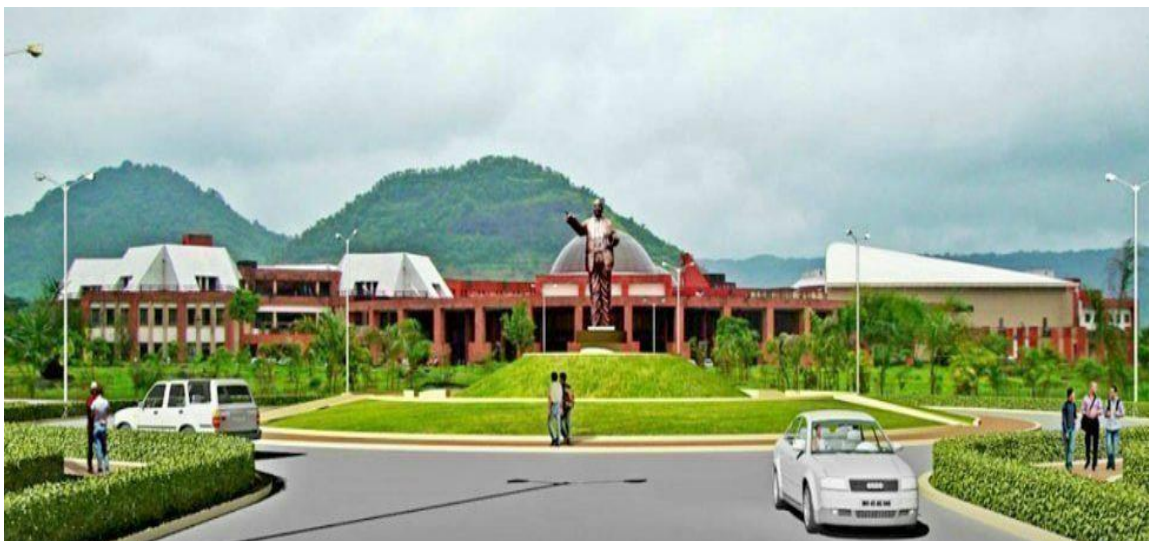
BCA

(BACHELOR OF COMPUTER APPLICATION)

AS PER AICTE's GUIDELINES

WITH EFFECT FROM THE ACADEMIC YEAR 2024-2025

T.Y. BCA 2026-27



SEMISTER V

S.No.	Course Code	Course Title	Weekly Teaching Hours			Evaluation Scheme			Credits	Total Marks
			L	T	P	ISE	MSE	ESE		
1	BCA501T	Professional Elective – III	3	0	0	20	20	60	3	100
2	BCA502T	Professional Elective – IV	3	0	0	20	20	60	3	100
3	BCA503T	Professional Elective – V	3	0	0	20	20	60	3	100
4	BCA504T	Quantitative Techniques	0	2	0	20	20	60	2	100
TOTAL									11	400
Lab Practicals										
5	BCA501P	Professional Elective-IV Lab	0	0	4	50	0	50	2	100
6	BCA502P	Professional Elective-IV Lab	0	0	4	50	0	50	2	100
7	BCA503P	Professional Elective – V Lab	0	0	4	50	0	50	2	100
8	BCA505P	Internship/capstone Project	0	0	8	50	0	50	4	100
9	BCA506P	Major Project [evaluation in sixth semester]	-	-	-	-	-	-	-	-
TOTAL									10	400

Professional Elective to be selected from the Proposed Streams with Discipline-Specific Electives – Data Science / Artificial Intelligence and Machine Learning / Full Stack Development proposed by Universities as indicated at the appendix - I

SEMISTER VI

S.No.	Course Code	Course Title	Weekly Teaching Hours			Evaluation Scheme			Credits	Total Marks
			L	T	P	ISE	MSE	ESE		
1	BCA601T	Generative AI	2	0	4	20	20	60	2	100
2	BCA602T	Professional Elective – VI	3	0	4	20	20	60	3	100
3	BCA603T	Professional Elective – VII	3	0	4	20	20	60	3	100
4	BCA604T	Soft Skills	0	1	0	20	20	60	1	100
TOTAL									9	400
Lab Practicals										
5	BCA601P	Generative AI Lab	0	0	4	50	0	50	2	100
6	BCA602P	Professional Elective – VI Lab	0	0	4	50	0	50	2	100
7	BCA603P	Professional Elective – VII Lab	0	0	4	50	0	50	2	100
8	BCA605T	Major Project [Initiated in 5th Semester]	0	0	8	50	0	50	4	100
TOTAL									10	400

Professional Elective to be selected from the Proposed Streams with Discipline-Specific Electives – Data Science / Artificial Intelligence and Machine Learning / Full Stack Development proposed by Universities as indicated at the appendix.

SEMESTER- V

BCA501T	Professional Elective -III a)Introduction to data science	3L:0T:0P	3 Credits
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Course Objectives

CO1: Understand concepts and applications of Data Science.

CO2: Perform data preprocessing and visualization.

CO3: Apply statistical and machine learning techniques.

CO4: Analyze data for practical applications and decision making.

Course Content:

UNIT I:

Fundamentals of Data Science :Introduction to Data Science, Data Science Process, Types of Data, Data Collection Methods Data Science Applications, Tools and Technologies for Data Science, Introduction to Python and Jupyter Notebook.

UNIT II:

Data Preprocessing: Data Cleaning, Handling Missing Values, Data Transformation, Data Integration, Data Reduction, Descriptive Statistics, Data Visualization Techniques.

UNIT III:

Statistical Analysis and Machine Learning Probability Concepts, Correlation and Regression, Classification Techniques, Clustering Methods, Introduction to Machine Learning, Supervised and Unsupervised Learning.

UNIT IV:

Data Analytics and Applications: Predictive Analytics, Data Interpretation, Big Data Basics, Data Ethics and Security, Real-world Data Science Applications, Case Studies in Data Science

Text Books

1. Laura Igual and Santi Seguí, Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications, Springer International Publishing, 2017.
2. Joel Grus, Data Science from Scratch: First Principles with Python, 2nd Edition, O'Reilly Media, 2019.
3. Cathy O'Neil and Rachel Schutt, Doing Data Science: Straight Talk from the Frontline, O'Reilly Media, 2013.
4. Jake VanderPlas, Python Data Science Handbook, O'Reilly Media, 2016.

Reference Books

1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy and Jupyter, 2nd Edition, O'Reilly Media, 2017.
2. Peter Bruce, Andrew Bruce and Peter Gedeck, Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, 2nd Edition, O'Reilly Media, 2020.
3. Jure Leskovec, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets Cambridge University Press, 2020.
4. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly Media, 2013.
5. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Web Resources

1. Kaggle – Datasets, notebooks and Data Science competitions.
2. Python Official Documentation – Python programming reference and tutorials.
3. NumPy Documentation – Numerical computing library documentation.
4. Pandas Documentation – Data analysis and manipulation tutorials.
5. Matplotlib Documentation – Data visualization library documentation.

BCA501T	Professional Elective –III b) Neural Network	3L:0T:0P	3 Credits
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Course Objectives

- CO1: Understand concepts and models of neural networks.
- CO2: Apply multilayer neural networks and backpropagation.
- CO3: Analyze advanced neural network architectures.
- CO4: Implement deep learning techniques for real-world applications.

Course Content:

UNIT I:

Introduction to Neural Networks: Introduction to Artificial Intelligence and Neural Networks Biological Neuron and Artificial Neuron Model, Characteristics of Neural Networks Types of Activation Functions, McCulloch-Pitts Model, Learning Rules and Learning Paradigms Single Layer Perceptron Model

UNIT II:

Multilayer Neural Networks: Multilayer Perceptron (MLP), Backpropagation Algorithm Gradient Descent Method, Error Minimization Techniques, Training and Testing of Neural Networks, Feed Forward Neural Networks

UNIT III:

Neural Network Architectures:- Radial Basis Function Networks, Recurrent Neural Networks (RNN) Hopfield Networks, Self Organizing Maps (SOM), Boltzmann Machines, Associative Memory Networks

UNIT IV:

Deep Learning and Applications:- Introduction to Deep Learning, Convolutional Neural Networks (CNN), Natural Language Processing Basics, Image and Speech Recognition Neural Networks in Data Mining, Applications of Neural Networks in Healthcare and Business

Text Books

1. Simon Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson Education, 2009.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw Hill, 2004.
3. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, Wiley India, 2018.

Reference Books

1. Laurene Fausett, Fundamentals of Neural Networks, Pearson Education, 1994.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
3. Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
4. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer, 2018.

Web Resources

1. TensorFlow Documentation
2. PyTorch Tutorials
3. Keras Documentation

BCA501T	Professional Elective – III C) Web Programming III(Java Springboot)	3L:0T:0P	3Credits
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Course Objectives

CO1: Understand the basics of web technologies using HTML, CSS, and JavaScript.

CO2: Develop web applications using JSP, Servlets, and JDBC.

CO3: Understand Spring Framework and Spring MVC concepts.

CO4: Build simple Spring Boot applications and REST APIs with database connectivity

Course Content:

Unit I: Web Technologies Basics

Introduction to Web Technologies, Client-Server Architecture, HTTP and HTTPS Protocols, Basics of HTML5, Forms and Tables, CSS for Web Page Design, JavaScript Basics, DOM Manipulation, Events and Validation, Responsive Web Design.

Unit II: JSP, Servlets and JDBC

Introduction to Java Web Programming, Servlet Life Cycle, Handling Client Requests and Responses, Session Management, Cookies and URL Rewriting, JSP Basics, JSP Directives and Action Tags, JDBC Architecture, Database Connectivity using JDBC, CRUD Operations with MySQL.

Unit III: Spring Framework and Spring MVC

Introduction to Spring Framework, Spring Architecture, Dependency Injection and Inversion of Control, Bean Configuration, Spring MVC Architecture, Controllers and Views, Form Handling in Spring MVC, Validation and Exception Handling.

Unit IV: Spring Boot, REST APIs and Deployment

Introduction to Spring Boot, Spring Boot Features and Architecture, Creating Spring Boot Applications, RESTful Web Services, CRUD REST APIs, JSON Data Handling, Introduction to Spring Security, JPA/Hibernate Basics, Application Packaging and Deployment using Tomcat Server.

Text Books

1. Hans Bergsten, “Java Server Pages”, O’Reilly Publications.
2. Craig Walls, “Spring Boot in Action”, Manning Publications.
3. Bhav, “Programming with Java”, Pearson Education.

Reference Books

1. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Pearson Education.
2. Thomas A. Powell, “HTML & CSS: The Complete Reference”, McGraw Hill.
3. Jon Duckett, “HTML and CSS: Design and Build Websites”, Wiley Publications.

Web Resources

1. <https://spring.io/projects/spring-framework>

BCA501P	Professional Elective –III Lab a) Introduction to Data Science Laboratory	0L:0T:4P	2 Credits
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Course Prerequisites

Basic Computer Knowledge Fundamentals of Programming, Basic Mathematics and Statistics

Course Objective:-

CO1: Understand Python programming for Data Science.

CO2: Perform data preprocessing and data handling.

CO3: Apply visualization and statistical analysis techniques.

CO4: Implement basic machine learning algorithms.

CO5: Analyze real-world datasets using Data Science tools.

Lab Experiments:-

1. Introduction to Python and Data Science Environment
2. Write Python programs using variables, operators and input/output functions
3. Implement control statements and looping constructs in Python
4. Perform operations on lists, tuples, dictionaries and sets
5. Implement functions and modules in Python
6. Create NumPy arrays and perform array operations
7. Perform data manipulation using Pandas
8. Read and write CSV and Excel files using Python
9. Handle missing data and perform data cleaning
10. Generate statistical summaries of datasets

BCA501P	Professional Elective – III Lab b) Neural Network Lab	0L:0T:4P	2 Credits
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List of Experiments:

1. Study of Python libraries for Neural Networks (NumPy, Pandas, Matplotlib, TensorFlow/Keras).
2. Implementation of basic perceptron model for logical operations (AND, OR, NOT).
3. Implementation of single layer neural network for classification problems.
4. Implementation of multi-layer perceptron using backpropagation algorithm.
5. Training a neural network using gradient descent optimization.
6. Design and implementation of Hebbian Learning Network.
7. Implementation of McCulloch-Pitts Neural Network model.
8. Development of Adaline and Madaline neural network models.
9. Implementation of Hopfield Neural Network for associative memory.
10. Implementation of Bidirectional Associative Memory (BAM).

1) BCA501P 2)	Professional Elective – III Lab C) Web Programming III Lab (Java Springboot)	0L:0T:4P	2 Credits
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List of Experiments:

- 1) Design a web page using CSS for colors, fonts, borders and responsive layout.
- 2) Create a simple web page using HTML5 tags, headings, tables, lists and forms.
- 3) Write a JavaScript program for form validation using events and DOM manipulation.
- 4) Develop a simple Servlet program to display student information using request and response objects.
- 5) Create a JSP page for student registration form and display submitted details.
- 6) Perform database connectivity using JDBC and MySQL to insert and display records.
- 7) Develop a CRUD application using JSP, Servlet and JDBC for student data management.
- 8) Insert and display student records using JDBC.
- 9) Create a simple Spring Boot application to display “Welcome to Spring Boot”. 10. Create a basic REST API in Spring Boot to display student data.

BCA502T	Professional Elective – IV a) Time Series analysis	3L:0T:0P	3 Credits
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Course Objectives

CO1: Understand concepts and applications of Data Science.

CO2: Perform data preprocessing and visualization.

CO3: Apply statistical and machine learning techniques.

CO4: Analyze data for practical applications and decision making.

Course Content:

UNIT I:

Introduction to Time Series: Definition and Components of Time Series Types of Time Series Data, Trend, Seasonal, Cyclical and Irregular Variations Additive and Multiplicative Models, Time Series Visualization Techniques Measurement of Trend: Moving Average Method, Least Square Method Seasonal Index and Deseasonalization

UNIT II:

Stationary Processes and Smoothing Methods: Stationarity and Non-Stationarity Autocorrelation and Partial Autocorrelation Functions, White Noise Process Exponential Smoothing Techniques: Simple Exponential Smoothing, Holt's Linear Trend Method, Holt-Winters Method, Model Selection and Forecast Accuracy Measures: MAE, MSE, RMSE, MAPE

UNIT III:

ARIMA Models: Introduction to AR, MA and ARMA Models
ARIMA Model: Identification, Estimation, Diagnostic Checking. Box-Jenkins Methodology Differencing and Transformation, Forecasting using ARIMA Models Introduction to SARIMA Models.

UNIT IV:

Advanced Time Series Techniques: Multivariate Time Series Analysis Vector Auto Regression (VAR), Introduction to State Space Models, Time Series using Machine Learning Applications in: Finance Weather Forecasting Sales Prediction Healthcare Analytics

Text Books

1. Time Series Analysis and Its Applications – Robert H. Shumway & David S. Stoffer, Springer, 2017.
2. Introduction to Time Series and Forecasting – Peter J. Brockwell & Richard A. Davis, Springer, 2016.

Reference Books

1. Forecasting: Principles and Practice – Rob J Hyndman & George Athanasopoulos, OTexts, 2021.
2. Applied Time Series Analysis – Terence C. Mills, Academic Press, 2019.
3. Practical Time Series Forecasting with R – Galit Shmueli & Kenneth C. Lichtendahl Jr., Axelrod Schnall Publishers, 2016.

Web Resources

- [NPTEL – Time Series Analysis Course](#)
- [Coursera – Time Series Forecasting Courses](#)
- [Kaggle Time Series Tutorials](#)

BCA502T	Professional Elective – IV b) Digital Image Processing	3L:0T:0P	3Credits
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Course Objective:-

CO1: Understand concepts of digital image processing.

CO2: Apply image enhancement and filtering techniques.

CO3: Analyze image transformation and compression methods.

CO4: Implement segmentation and object recognition techniques.

Unit I :- Fundamentals of Digital Image Processing 7 hours

Introduction to Digital Image Processing, Image Sampling and Quantization Image Representation, Pixels and Gray Level Resolution, Elements of Visual Perception Applications of Image Processing, Image Acquisition Systems.

Unit II :- Image Enhancement Techniques 7 hours

Spatial Domain Methods, Gray Level Transformations, Histogram Processing Image Smoothing and Sharpening, Filtering Techniques, Noise Models and Noise Reduction

Unit III :- Image Transformation and Compression 7 hours

Fourier Transform, Discrete Cosine Transform (DCT), Wavelet Transform, Image Compression Fundamentals, Lossless and Lossy Compression, JPEG Compression Technique

Unit IV:- Image Segmentation and Applications 7 hours

Edge Detection, Thresholding Techniques, Region-Based Segmentation, Morphological Image Processing, Object Recognition, Applications in Medical Imaging and Computer Vision

Text Books:-

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson Education, 2018.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 1989.

Reference Book

1. Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, Digital Image Processing Using MATLAB, McGraw Hill Education, 2020.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Cengage Learning, 2014.
3. S. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, McGraw Hill Education, 2017.

BCA502T	Professional Elective – IV c) Web Programming using Django & Flask	3L:0T:0P	3 Credits
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Course Objectives

CO1: Understand the basics of Python programming and web technologies.

CO2: Develop simple web pages and web applications using HTML, CSS, and Flask.

CO3: Build web applications using Django framework and database connectivity.

CO4: Develop basic CRUD-based web applications and understand deployment concepts.

Course Content:

Unit I: Introduction to Python and Web Programming

Introduction to Web Programming, Client-Server Architecture, HTTP and HTTPS Basics, Introduction to Python, Variables and Data Types, Operators, Conditional Statements, Loops, Functions, Modules and Packages, Introduction to Web Frameworks.

Unit II: HTML, CSS and Flask Framework

HTML5 Basics, Forms and Tables, CSS Basics, JavaScript Introduction, Introduction to Flask Framework, Flask Application Structure, Routing and View Functions, Templates in Flask, Form Handling, Simple Flask Web Applications.

Unit III: Django Framework

Introduction to Django, Django Installation and Project Structure, Creating Django Applications, URL Mapping, Views and Templates, Static Files, Forms Handling, Django Admin Panel, Model-View-Template (MVT) Architecture.

Unit IV: Database Connectivity and Deployment

Introduction to SQLite/MySQL, Models in Django, CRUD Operations, User Authentication Basics, Introduction to REST API Concepts, Testing and Debugging, Application Deployment Basics.

Text Books

1. Flask Web Development – Miguel Grinberg, O'Reilly Publications.
2. Django for Beginners– William S. Vincent, WelcomeToCode Publications.

Reference Books

1. Django 3 By Example – Antonio Mele, Packt Publications.
2. HTML and CSS: Design and Build Websites – Jon Duckett, Wiley Publications.
3. Web Development with Python and Django – Ben Shaw, Packt Publications.

Web Resources

1. <https://docs.python.org/3/>
2. <https://www.djangoproject.com/>
3. <https://nptel.ac.in/courses/106106145>

BCA502P	Professional Elective – IV Lab a) Time Series analysis Lab	0L:0T:4P	2 Credits
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Lab Experiments:

1. Study and plot time series data.
2. Implement moving average method for smoothing.
3. Perform trend analysis on time series data.
4. Analyze seasonal variations in data.
5. Implement exponential smoothing technique.
6. Forecast future values using linear trend method.
7. Apply ARIMA model for time series forecasting.
8. Compare actual and forecasted values.
9. Visualize time series data using graphs.
10. Detect cyclic and irregular variations in data.
11. Perform time series decomposition.
12. Implement autocorrelation analysis.
13. Analyze stationarity of time series data.
14. Apply differencing techniques for stationary data.
15. Forecast sales data using time series methods.
16. Perform stock market trend prediction.
17. Analyze weather forecasting data.
18. Implement moving average crossover analysis.
19. Compare forecasting models for accuracy.
20. Mini Project based on Time Series Forecasting Applications.

BCA502P	Professional Elective – IV Lab b) Digital Image Processing Lab	0L:0T:4P	2 Credits
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Lab Experiments:

1. Read and display an image using Python/OpenCV.
2. Convert a color image into grayscale image.
3. Perform image resizing and cropping operations.
4. Implement image negative transformation.
5. Perform brightness and contrast enhancement.
6. Apply histogram equalization on an image.
7. Implement image smoothing using averaging and Gaussian filters.
8. Perform image sharpening using Laplacian filter.
9. Detect edges using Sobel operator.
10. Detect edges using Canny edge detection technique.
11. Perform image thresholding and segmentation.
12. Implement morphological operations such as dilation and erosion.
13. Perform opening and closing operations on binary images.
14. Convert RGB image to HSV color model.
15. Apply noise removal techniques on images.
16. Perform Fourier Transform on an image.
17. Implement image compression techniques.
18. Detect objects in an image using contour detection.
19. Perform face detection using OpenCV.
20. Mini Project based on Digital Image Processing applications.

BCA502P	Professional Elective – IV Lab c) Web Programming using Django & Flask	0L:0T:4P	2 Credits
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Lab Experiments:

1. Write a Python program to perform basic arithmetic operations.
2. Write a Python program using conditional statements and loops.
3. Create a simple HTML web page using headings, tables, lists and images.
4. Design a web page using CSS for colors, fonts and backgrounds.
5. Create an HTML form and validate input using basic JavaScript.
6. Install Flask and create a simple Flask application to display “Hello World”.
7. Create a Flask application with multiple web pages using routing.
8. Develop a Flask form application to accept and display student information.
9. Install Django and create a simple Django project with one application.
10. Create a basic Django application to insert and display student records using SQLite database.

BCA503T	Professional Elective V A) Machine Learning	3L:0T:0P	3 Credits
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Prerequisite:

1. Basic knowledge of Mathematics (Statistics & Probability)
2. Basic Programming skills.
3. Understanding of Data Structures
4. Basic knowledge of algorithms and logic building

Course Objectives :

CO1: Understand basic concepts and types of Machine Learning.

CO2: Apply supervised learning methods like classification and regression.

CO3: Understand Bayesian learning and theoretical concepts of ML.

CO4: Apply advanced algorithms like SVM, neural networks, and ensemble methods.

CO5: Use clustering and recommendation techniques to analyze data.

Course Content:

UNIT I: Machine Learning(7 Hours)

Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine Learning, Basic definitions, types of learning, Concept Learning and General-to-specific Ordering; A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis

UNIT II: Machine Learning(7 Hours)

Supervised Learning, Classification & Regression, Performance Metrics for Classification Problems, Performance Metrics for Regression Problems, Linear regression, Decision trees, over fitting.

UNIT III: Machine Learning(7 Hours)

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier.

UNIT IV: Machine Learning(7 Hours)

Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM, Ensemble Learning, Bagging, Random Forest, Boosting, AdaBoost, Stacking, Perceptron, multilayer network, back propagation, introduction to deep neural network.

UNIT V: Machine Learning(7 Hours)

Clustering k-means, adaptive hierarchical clustering, Gaussian mixture model, Association Rules Mining and Recommendation Systems. What are Association Rules, Association Rule Parameters, Calculating Association Rule Parameters, Recommendation Engines, Recommendation Engines working

Text Books

1. Tom M. Mitchell – *Machine Learning*, McGraw-Hill
2. Ethem Alpaydin – *Introduction to Machine Learning*, MIT Press
3. Stephen Marsland – *Machine Learning: An Algorithmic Perspective*, CRC Press
4. Kevin P. Murphy – *Machine Learning: A Probabilistic Perspective*, MIT Press

Reference Books

1. Christopher M. Bishop – *Pattern Recognition and Machine Learning*, Springer
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman – *The Elements of Statistical Learning*, Springer
3. Andreas C. Müller & Sarah Guido – *Introduction to Machine Learning with Python*, O'Reilly
4. Aurélien Géron – *Hands-On Machine Learning with Scikit-Learn & TensorFlow*, O'Reilly

Web Resources

1. <https://www.coursera.org> (Machine Learning courses by Andrew Ng)
2. <https://www.edx.org> (AI & ML courses)
3. <https://scikit-learn.org> (ML library documentation)

BCA503T	Professional Elective – V B) Natural Language Processing	3L:0T:0P	3 Credits
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Prerequisite:

1. Basic knowledge of Programming (Python)
2. Fundamentals of Artificial Intelligence and Machine Learning
3. Basic concepts of Probability and Statistics

Course Objectives :

CO1: Understand basic concepts of Natural Language Processing and its applications.

CO2: Apply text preprocessing techniques like tokenization, stemming, and stop word removal.

CO3: Analyze language models such as N-grams and POS tagging.

CO4: Implement machine learning techniques for text classification and sentiment analysis.

CO5: Explore advanced NLP methods like NER, word embeddings, and chatbots.

Course Content:

UNIT I: Natural Language Processing

Introduction to NLP, Importance & Applications, NLP vs AI & ML, Challenges in NLP, Basic NLP Tasks, Components of NLP, Levels of Language Analysis (Morphology, Syntax, Semantics), NLP Pipeline

UNIT II:

Text Cleaning, Tokenization, Stop Words Removal, Stemming & Lemmatization, Regular Expressions, Text Normalization, Handling Noise Data, Word Frequency & Bag of Words

UNIT III:

N-grams (Unigram, Bigram, Trigram), Probability in NLP, Markov Models, POS Tagging, Syntax & Parsing, Hidden Markov Model (HMM), Language Modeling Basics

UNIT IV:

Machine Learning in NLP, Text Classification, Naive Bayes, Decision Trees, Sentiment Analysis, Feature Extraction (TF-IDF), Model Evaluation (Accuracy, Precision, Recall)

UNIT V:

Named Entity Recognition (NER), Word Embeddings, Chatbots, Speech Recognition, NLP Applications, Deep Learning Basics (RNN, LSTM), Transformers Introduction (BERT basic idea)

Text Books

1. Daniel Jurafsky & James H. Martin, Speech and Language Processing
 2. Steven Bird, Ewan Klein & Edward Loper, Natural Language Processing with Python
 3. Tanveer Siddiqui & U.S. Tiwary, Natural Language Processing and Information Retrieval
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1. Christopher D. Manning & Hinrich Schütze, *Foundations of Statistical Natural Language*

Reference Books

1. Jacob Eisenstein, *Introduction to Natural Language Processing*
2. Yoav Goldberg, *Neural Network Methods for Natural Language Processing*
3. Nitin Indurkha & Fred J. Damerau, *Handbook of Natural Language Processing*

Web Resources

1. <https://www.nltk.org>
2. <https://spacy.io>
3. <https://www.tensorflow.org>

BCA503T	Professional Elective – V c)Web Programming V (using React JS)	3L:0T:0P	3 Credits
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Course Objectives

CO1: Understand the basics of web technologies, HTML, CSS, JavaScript, and DOM manipulation.

CO2: Develop simple user interfaces using React JS components, props, and state.

CO3: Build React applications using forms, hooks, and routing concepts.

CO4: Develop basic React applications with API integration and CRUD operations.

Course Content:

Unit I: Introduction to Web Technologies and JavaScript

Introduction to Web Technologies, Client-Server Architecture, Basics of HTML5 and CSS, Introduction to JavaScript, Variables and Data Types, Operators, Conditional Statements and Loops, Functions and Events, DOM Manipulation, Introduction to JSON.

Unit II: Introduction to React JS

Introduction to React JS, Features and Advantages of React, React Environment Setup, Folder Structure, JSX Basics, Components in React, Functional Components, Props and State, Event Handling in React.

Unit III: React Forms, Hooks and Routing

Forms in React JS, Conditional Rendering, Lists and Keys, Introduction to React Hooks, useState and useEffect Hooks, React Router Basics, Navigation and Routing, Simple UI Design using Bootstrap.

Unit IV: React Applications and API Integration

Creating Simple React Applications, Introduction to REST APIs, Fetch API Basics, Displaying Data from APIs, CRUD Operation Basics, Error Handling Basics, Building and Deployment of React Applications.

Text Books

1. Alex Banks and Eve Porcello, “Learning React”, O’Reilly Publications
2. Jon Duckett, “HTML and CSS: Design and Build Websites”, Wiley Publications.

Reference Books

1. Stoyan Stefanov, “React: Up and Running”, O’Reilly Publications.
2. Ethan Brown, “Web Development with Node and Express”, O’Reilly Publications.

Web Resources

1. <https://react.dev/>
2. <https://nptel.ac.in/courses/106105084>
3. <https://www.w3schools.com/react/>

BCA503P	Professional Elective V Lab A) Machine Learning Lab	0L:0T:4P	2 Credits
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List of Experiments:

1. Write a Python program for data analysis and data visualization.
2. Write a Python program for data preprocessing and feature engineering.
3. Write a Python program to implement Simple and Multiple Linear Regression using a CSV file and find accuracy.
4. Write a Python program to implement Decision Tree (ID3) algorithm and classify new data.
5. Write a Python program to implement K-Nearest Neighbor (KNN) algorithm using Iris dataset and find accuracy.
6. Write a Python program to implement Naïve Bayes algorithm using a CSV file and find accuracy.
7. Write a Python program to implement Kernel Logistic Regression and visualize the model.
8. Write a Python program to implement Kernel SVM algorithm and find accuracy.
9. Write a Python program to implement Random Forest algorithm and visualize the model.
10. Write a Python program to implement AdaBoost algorithm and find accuracy.

BCA503P	Professional Elective V Lab b) Natural Language Processing Lab	0L:0T:4P	2 Credits
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Lab Experiments:

1. Study of Text Preprocessing in NLP using Python.
2. Implementation of Tokenization Techniques in NLP.
3. Implementation of Stop Word Removal using NLP libraries.
4. Implementation of Stemming and Lemmatization Techniques.
5. Implementation of Part-of-Speech (POS) Tagging.
6. Implementation of Named Entity Recognition (NER).
7. Implementation of Bag of Words Model for Text Representation.
8. Implementation of TF-IDF for Text Feature Extraction.
9. Implementation of Sentiment Analysis on Text Data.
10. Implementation of Spam Message Classification using NLP.

BCA503P	Professional Elective – V Lab c) Web Programming V (using React JS)	0L:0T:4P	2 Credits
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Lab Experiments:

- 1) Create a simple web page using HTML headings, lists, tables and images.
- 2) Design a web page using CSS for colors, fonts and layouts.
- 3) Write a JavaScript program using variables, conditions and loops.
- 4) Create a JavaScript program for form validation using DOM events.
- 5) Install React JS and create a simple React application to display “Hello World”.
- 6) Create a React functional component to display student information.
- 7) Develop a React application using props and state.

- 8) Create a React form application to accept and display user data.
- 9) Develop a React application using useState and useEffect hooks.
- 10) Create a simple React application to fetch and display data from a public API.

BCA504T	Quantitative Techniques	0L:2T:0P	2 Credits
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Prerequisite:

1. Basic knowledge of **Mathematics (Algebra & Arithmetic)**
2. Understanding of **Graphs and Charts**
3. Basic idea of **Statistics**

Course Objectives :

CO1: Understand basic concepts, importance, and applications of Quantitative Techniques.

CO2: Apply statistical methods like mean, median, correlation, and regression for data analysis.

CO3: Understand and solve problems based on probability and probability distributions.

CO4: Apply operations research techniques like LPP, transportation, and assignment problems.

CO5: Use decision-making techniques such as decision tree, game theory, and PERT & CPM.

Course Content:

UNIT I: Natural Language Processing (7 Hours)

Meaning & Definition of QT, Importance & Applications, Types of QT (Statistical, OR, Mathematical), Role in Decision Making, Steps in QT Approach, Limitations of QT, Scope of QT

UNIT II: (7 Hours)

Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Range, Variance, Standard Deviation), Skewness (Basics), Correlation (Karl Pearson), Regression (Simple), Index Numbers, Time Series (Basics)

UNIT III:(7 Hours)

Probability Concepts & Terminology, Types of Probability (Classical, Empirical), Laws of Probability (Addition & Multiplication), Conditional Probability, Bayes Theorem (Basic Idea), Probability Distributions (Binomial, Poisson, Normal), Applications

UNIT IV:(7 Hours)

Linear Programming Problem (Formulation), Graphical Solution Method, Simplex Method (Basic Idea), Transportation Problem (Initial Solution Methods), Assignment Problem, Inventory Control (EOQ, ABC Analysis), Replacement Models (Basics)

UNIT V:(7 Hours)

Decision Making (Certainty, Risk, Uncertainty), Payoff Table, Decision Tree Analysis, Game Theory (Pure & Mixed Strategy), Queuing Theory (Single Channel Model), Simulation (Monte Carlo Method), Network Analysis (PERT & CPM), Applications in Business

Text Books

1. V.K. Kapoor & S.C. Gupta – *Fundamentals of Mathematical Statistics*
2. P.N. Arora & S. Arora – *Quantitative Aptitude / Statistics*
3. K.K. Dewett – *Modern Economic Theory (for basic QT concepts)*

Reference Books

1. Taha H.A. – Operations Research: An Introduction
2. Anderson, Sweeney & Williams – Quantitative Methods for Business 3. Levin & Rubin –
3. Statistics for Management

Web Resources

1. NPTEL (IIT Lectures) – <https://nptel.ac.in>
2. Swayam Portal – <https://swayam.gov.in>
3. Coursera (Quantitative Methods Courses) – <https://www.coursera.org>

Internship/Capstone project

BCA505T	Internship/Capstone project	0L:0T:8P	4 Credits
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Course Objective:-

- To provide practical exposure to real-world industry or research problems through project-based learning.
- To develop problem-solving, analytical thinking, and decision-making skills using modern tools and technologies.
- To enhance technical, communication, teamwork, and project management skills in a professional environment.
- To apply theoretical knowledge gained during the program to design, develop, and implement innovative solutions.
- To prepare students for professional careers, higher studies, and entrepreneurship through hands-on experience and project presentation.

Internship/Capstone Project Guidelines:

- The project should focus on innovation and real-world problem solving, avoiding direct duplication of existing projects.
- Students must perform a Literature Review to study existing systems, research papers, and identify research gaps or limitations.
- Every project must include a clear Problem Statement, objectives, and a properly developed working model/prototype.
- The project should be completed within the stipulated timeline, following stages such as planning, development, testing, and review.
- Each group must submit a well-structured Project Report and present the project through final demonstration and viva evaluation.
- Internship should preferably be in a recognized industry, organization, startup, or research institute.
- Students must maintain:
 - Attendance record
 - Daily/weekly work diary
 - Internship completion certificate
 - Supervisor feedback/report

BCA505T	Major Project (Evaluation in 6th Semester)	0L:0T:0P	0 Credits
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Major Project Guidelines:

- Each major project group shall consist of 4 members, with equal participation from all team members.
- The project should focus on innovation and real-world problem solving, avoiding direct duplication of existing projects.
- Students must perform a Literature Review to study existing systems, research papers, and identify research gaps or limitations.
- Every project must include a clear Problem Statement, objectives, and a properly developed working model/prototype.
- The project should be completed within the stipulated timeline, following stages such as planning, development, testing, and review.
- Each group must submit a well-structured Project Report and present the project through final demonstration and viva evaluation.

SEMESTER- VI

BCA601T	Generative AI	2L:0T:0P	2 Credits
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Prerequisites:

Understanding of fundamentals of Artificial Intelligence or Machine Learning (optional but helpful). Basic knowledge of computer applications and software tools

Course Objectives:

CO1: Understand the fundamentals of Artificial Intelligence and Generative AI concepts

CO2: Explain the working of generative models such as Autoencoders, GANs, and Large Language Models (LLMs).

CO3: Apply Natural Language Processing (NLP) techniques to build basic text-based AI applications like chatbots.

Course Content:

UNIT I: Introduction to AI & Generative AI

Definition of Artificial Intelligence , AI vs Machine Learning vs Deep Learning ,What is Generative AI Applications of Generative AI (ChatGPT, Midjourney, etc.) ,Types of AI (Narrow, General, Super AI), Advantages and limitations of Generative AI ,Future scope of Generative AI

UNIT II: Foundations for Generative AI

Basics of Python (variables, loops, functions) ,Introduction to NumPy and Pandas ,Linear Algebra basics (vectors, matrices) ,Probability concepts (mean, variance, distributions) ,Neural Networks fundamentals ,Activation functions (ReLU, Sigmoid, Tanh) ,Backpropagation algorithm ,Introduction to Deep Learning ,Overview of Transformer architecture

UNIT III:Generative Models

Generative vs Discriminative models ,Probability-based generation concepts ,Autoencoders (encoder-decoder architecture) ,Variational Autoencoders (VAE) ,Generative Adversarial Networks (GANs) :Generator vs Discriminator ,Training process of GAN ,Diffusion models (basic idea) Introduction to Large Language Models (LLMs) ,Examples of generative models in real life

Unit IV: Natural Language Processing (NLP)

Text preprocessing techniques ,Language models ,Chatbots and virtual assistants ,Tools: GPT, BERT (basic idea) ,Text generation techniques

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press, 2016.
2. David Foster, *Generative Deep Learning*, O'Reilly Media, 2019.
3. Anand Vemula, *Generative AI and Deep Learning*, Atlantic Publishers, 2024.

Reference Books:

1. Sebastian Raschka, Vahid Mirjalili, *Python Machine Learning*, Packt Publishing, 3rd Edition, 2019.
2. François Chollet, *Deep Learning with Python*, Manning Publications, 2nd Edition, 2021.

Web Resources:

1. <https://nptel.ac.in/courses/106106224>
2. <https://nptel.ac.in/courses/106106184>

BCA601P	Generative AI Lab	0L:0T:4P	2 Credits
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List Of Experiments

1. Design a program to demonstrate the working of a stack using an array. Include operations to insert, delete, and display elements.
2. Develop a program to simulate a queue data structure using an array with insertion and deletion operations.
3. Create a program that searches for a given element in a list using the linear search technique.
4. Write a program to locate an element in a sorted array using the binary search method.
5. Implement a program to arrange elements in ascending order using the bubble sort algorithm.
6. Write a program to create a singly linked list and perform insertion of nodes at the beginning.
7. Develop a recursive program to calculate the factorial of a given number.
8. Write a program to generate and display Fibonacci sequence for a specified number of terms.
9. Create a program to add two matrices and display the resultant matrix.
10. Develop a program to write data into a file and read the same data back using file handling concepts.

BCA602T	Professional Elective – VI a)Big Data Analytics	3L:0T:0P	3 Credits
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Course Objectives

CO1: To implement MapReduce programs for processing big data.

CO2: To realize storage and processing of big data using MongoDB, Pig, Hive, and Spark.

CO3: To analyze big data using machine learning techniques.

Prerequisites :

Basic knowledge of programming concepts (preferably in Java, Python, or similar languages).

Understanding of data structures such as arrays, lists, stacks, and queues.

Familiarity with database management systems (DBMS) and basic SQL queries.

Course Content:

UNIT I: Introduction to Big Data

Concepts: Classification of data, Characteristics (V's), Evolution, and Definition of Big Data.

Business Intelligence: Traditional Business Intelligence vs. Big Data, Typical Data Warehouse and Hadoop environment.

Analytics: What is Big Data Analytics, Classification of Analytics, and the importance of Big Data Analytics.

Technology Stack: Technologies used in Big Data environments, Top Analytical Tools, NoSQL, and Hadoop.

UNIT II: Hadoop & MapReduce

Hadoop Overview: Why Hadoop? RDBMS vs. Hadoop, History of Hadoop, and HDFS (Hadoop Distributed File System).

Architecture: Use cases of Hadoop, processing data with Hadoop, and managing resources/applications with **Hadoop YARN**.

MapReduce Programming: Introduction to MapReduce, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, and Compression.

UNIT III: NoSQL & MongoDB

Introduction to MongoDB: What is MongoDB? Why use it?

Architecture: Terms used in RDBMS vs. MongoDB, Data types in MongoDB.

Operations: MongoDB Query Language (CRUD operations).

UNIT IV: Introduction to Hive

Concepts: What is Hive? Hive Architecture.

Technical Details: Hive data types, Hive file formats, Hive Query Language (HQL).

Implementation: RC File implementation and User Defined Functions (UDF).

Textbooks

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.

Reference Books

1. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems", O'Reilly, 2012.
2. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, 2015.
3. Thomas Erl, Wajid Khattak, and Paul Buhler, "Big Data Fundamentals: Concepts, Drivers & Techniques", Pearson India Education Service Pvt. Ltd., 1st Edition, 2016.

Web Resources

1. <https://nptel.ac.in/courses/106104189>
2. <https://nptel.ac.in/courses/106106142>
3. <https://nptel.ac.in/courses/1061050>

BCA602T	Professional Elective – VI b)Deep Learning for Computer Vision	3L:0T:0P	3 Credits
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Prerequisite: Basic understanding of programming (preferably Python), linear algebra, probability and **statistics**, and fundamental concepts of machine learning and image processing. Familiarity with data structures and basic algorithms is also recommended.

Course Objectives

CO1: Understand the fundamentals of deep learning and its role in computer vision applications.

CO2: Explain and implement basic neural network architectures such as CNN (Convolutional Neural Networks).

CO3: Apply deep learning techniques for image classification and object detection tasks.

Course Content:

UNIT I: Foundations of Computer Vision

Basics of Image Formation: Digital image representation, pixels, color spaces (RGB, HSV, Gray-scale).

Image Processing Fundamentals: Linear filtering, correlation, and convolution.

Classical Feature Extraction: Edge detection (Canny, Sobel), Corner detection (Harris), and Local features (SIFT, SURF, HOG).

UNIT II: Neural Network Fundamentals

Review of Deep Learning: Multi-layer Perceptrons (MLP), Activation functions (ReLU, Sigmoid, Tanh).

Training Dynamics: Backpropagation, Gradient Descent variants (SGD, Adam), and Loss functions (Cross-entropy, MSE).

Regularization: Dropout, Batch Normalization, and Weight Initialization.

UNIT III: Convolutional Neural Networks (CNNs)

CNN Architecture: Convolution layers, Pooling (Max/Average), Fully Connected layers.

Classic Architectures: Study of landmark models like **AlexNet**, **VGG**, **Inception**, and **ResNet**.

Visualization: Understanding what CNNs learn through deconvolution and saliency maps (Grad-CAM).

UNIT IV: Advanced Vision Tasks

Object Detection: Concepts of Bounding Boxes, Intersection over Union (IoU); Introduction to models like **YOLO** (You Only Look Once) and **R-CNN**.

Image Segmentation: Semantic vs. Instance segmentation; Architectures like **U-Net** and **Mask R-CNN**.

Video Understanding: Introduction to Recurrent Neural Networks (RNNs) and LSTMs for action recognition in video.

Text Books

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.
2. Richard Szeliski, Computer Vision: Algorithms and Applications.
3. Eugene Charniak, Introduction to Deep Learning.

Reference Books

1. Adam Shook and Donald Mine, MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems, O'Reilly, 2012.
2. Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, 2015.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc24_cs59/preview
2. https://onlinecourses.nptel.ac.in/noc25_cs21/preview
3. https://onlinecourses.nptel.ac.in/noc26_cs66/preview

BCA602T	Professional Elective – VI C) Web Programming VI (using React JS)	3L:0T:0P	3 Credits
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Course Objectives

CO1: Understand the basics of UI/UX design principles and user-centered design concepts.

CO2: Develop simple and responsive web page designs using HTML and CSS.

CO3: Create basic wireframes, prototypes, and user interface designs using UI/UX tools.

CO4: Apply usability, accessibility, and user experience principles in web application design.

Course Content:

Unit I: Introduction to UI/UX Design

Introduction to UI and UX, Difference between UI and UX, Importance of UI/UX in Web Applications, Principles of Good Design, User-Centered Design, Basics of Color Theory, Typography and Layout Design.

Unit II: Web Design Fundamentals

Basics of Web Page Structure using HTML5 and CSS, Responsive Web Design Basics, Introduction to Wireframes and Mockups, Navigation Design, Forms and Buttons Design, Designing User-Friendly Web Pages.

Unit III: UI/UX Design Tools and Prototyping

Introduction to Design Tools (Figma/Adobe XD), Creating Simple Wireframes, Prototyping Basics, User Flow and Screen Design, Icons and Visual Elements, Designing Simple Mobile and Web Interfaces

Unit IV: User Experience and Testing

Introduction to User Research, User Personas, Usability Principles, Feedback and Accessibility, UI/UX Evaluation Basics, Designing Simple Projects and Portfolio Preparation.

Text Books

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs, “Designing the User Interface: Strategies for Effective Human Computer Interaction”, Pearson Education.
2. Alan Cooper, Robert Reimann, David Cronin and Christopher Noessel, “About Face: The Essentials of Interaction Design”, Wiley Publications.

Reference Books

1. Jennifer Tidwell, “Designing Interfaces”, O’Reilly Publications.
2. Jesse James Garrett, “The Elements of User Experience”, Pearson Education.

Web Resources

1. <https://www.w3schools.com/html/>
2. <https://www.interaction-design.org/>
3. <https://nptel.ac.in/courses/106106224>

BCA602P	Professional Elective – VI Lab a)Big Data Analytics Lab	0L:0T:4P	2 Credits
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Lab Experiments:

1. Write a program to perform Word Count using Hadoop MapReduce.
2. Demonstrate basic HDFS file operations using Hadoop commands.
3. Write a Python program to count the frequency of words in a text file.
4. Create a Pandas DataFrame and perform basic data analysis on student marks.
5. Write a program to read data from a CSV file using Python Pandas.
6. Create a bar chart for student marks using Matplotlib.
7. Write a PySpark program to create and display a DataFrame.
8. Write a program to find maximum, minimum, and average values from a dataset.
9. Perform simple log file analysis to count error messages.
10. Write a program to sort and filter data from a dataset using Python or Spark.

BCA602P	Professional Elective – VI b)Deep Learning for Computer Vision	0L:0T:4P	2 Credits
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Lab Experiments:

1. Load and display an image using Python.
2. Convert a color image into grayscale.
3. Resize an image using OpenCV.
4. Rotate an image by 90 degrees.
5. Flip an image horizontally.
6. Detect edges in an image using Canny edge detection.
7. Apply blur effect to an image.
8. Draw shapes (line, rectangle, circle) on an image.

BCA602P	Professional Elective – VI Lab C) Web Programming VI (using React JS) Lab	0L:0T:4P	2 Credits
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Lab Experiments:

1. Create a simple web page using HTML headings, paragraphs, lists and images.
2. Design a web page using CSS for colors, fonts, borders and backgrounds.
3. Create a responsive web page layout using CSS.
4. Design a simple login and registration form using HTML and CSS.
5. Create a navigation menu and user-friendly webpage layout.
6. Design a simple wireframe for a website using Figma or drawing tools.
7. Create a prototype for a mobile or web application using Figma.
8. Design a user interface for a student information webpage.
9. Evaluate a website interface based on usability and accessibility principles.
10. Design a simple responsive website using basic UI/UX principles.

BCA603T	Professional Elective VII A)Exploratory Data Analysis	3L:0T:0P	3 Credits
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Prerequisites:

Basic computer literacy including file management and software usage.

Introductory awareness of Data Science concepts is recommended.

Willingness to work with Python-based tools such as Pandas, NumPy, Matplotlib, and Seaborn

Course Objectives:

CO1: To introduce the fundamentals of Data Science and Exploratory Data Analysis, including data types, analytics lifecycle, and data collection methods.

CO2: To develop skills in data cleaning, preprocessing, transformation, normalization, and handling missing values and outliers using Pandas.

CO3: To understand and apply descriptive statistical techniques such as measures of central tendency, dispersion, probability, and correlation analysis

CO4: To enable students to visualize and analyze data using tools like Matplotlib, Seaborn, and Plotly for multivariate and time-series analysis.

Course Content:

UNIT I: Introduction to Exploratory Data Analysis

Introduction to Data Science, Need for EDA, Types of Data, Data Analytics Lifecycle
Data Collection Methods, Data Understanding, Structured vs Unstructured

UNIT II: Data Cleaning & Preprocessing

Missing Value Treatment, Data Cleaning, Noise Handling, Duplicate Removal Data
Transformation, Data Reduction, Normalization & Standardization Handling Outliers,
Practical Concepts, Null value handling using Pandas Scaling datasets

UNIT III — Descriptive Statistics

Mean, Median, Mode, Variance & Standard Deviation, Quartiles & Percentiles Skewness
& Kurtosis, Probability basics, Correlation analysis

UNIT IV — Data Visualization , Multivariate & Time-Series Analysis

Histograms , Bar Charts, Pie Charts, Scatter Plots, Line Charts, Box Plots Heatmaps, Pair
Plots, Visualization Tools, Matplotlib Seaborn, Plotly, Covariance, Correlation Matrix,
Feature Relationships Time-series Visualization, Trend & Seasonality, Introduction to
PCA

Text Books:

1. John W. Tukey, Exploratory Data Analysis, Pearson (originally Addison-Wesley).
2. David C. Hoaglin, Frederick Mosteller, Understanding Robust and Exploratory Data Analysis, Wiley.
3. Hadley Wickham, Garrett Golemund, R for Data Science, O'Reilly Media.
4. Wes McKinney, Python for Data Analysis, O'Reilly Media.
5. Allen B. Downey, Think Stats, O'Reilly Media.

Reference Books:

1. Edward R. Tufte, The Visual Display of Quantitative Information, Graphics Press.
Hadley Wickham, ggplot
2. Elegant Graphics for Data Analysis, Springer.

Web Resources:

1. <https://nptel.ac.in/courses/106106224>
2. <https://nptel.ac.in/courses/106106184>

BCA603T	Professional Elective-VII B)Predictive Analysis	3L:0T:0P	3 Credits
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Prerequisites :

Basic understanding of mathematics, especially statistics and probability concepts.
Fundamental knowledge of programming concepts such as variables, loops, and functions.
Familiarity with basic data handling concepts like tables, datasets, and spreadsheets.

Course Objectives

CO1: Predictive analytics fundamentals
CO2: Prepare datasets for predictive modelling
CO2: Build and evaluate regression models
CO3: Develop classification models for prediction tasks

Course Content:

UNIT I: Introduction to Predictive Analytics

Introduction to Analytics, Types of Analytics, Descriptive, Diagnostic
Predictive, Prescriptive, Predictive Analytics Lifecycle
Business Applications, Data Collection & Understanding
Introduction to Machine Learning, Differentiate between analytics types

UNIT II: Data Preprocessing & Regression Techniques

Data Cleaning, Missing Value Treatment, Outlier Detection
Data Transformation, Feature Engineering, Encoding Categorical Variables
Data Normalization & Standardization, Train-Test Split
Introduction to Regression, Simple Linear Regression, Multiple Linear Regression
Polynomial Regression, Regression Assumptions, Model Evaluation Metrics
Outcomes

UNIT III: Classification Techniques, Time-Series & Forecasting

Introduction to Classification, Logistic Regression, K-Nearest Neighbors (KNN)
Decision Trees, Naive Bayes, Support Vector Machine (SVM), Evaluation Metrics
Accuracy, Precision, Introduction to Time-Series Data, Trend & Seasonality
Moving Average, Exponential Smoothing, Forecasting Techniques
ARIMA Basics, Sales & Demand Forecasting

UNIT IV: Predictive Analytics Using Python

Data Analysis using Pandas, Visualization using Matplotlib & Seaborn
Building ML Models using Scikit-learn, Model Training & Testing
Hyperparameter Tuning Basics, Libraries, Python, Pandas, NumPy, Scikit-learn
Matplotlib, Seaborn

Textbooks

1. Max Kuhn, Kjell Johnson, Applied Predictive Modeling, Springer.
2. Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley.

3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning, Springer.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.

Reference Books

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media.
- 2 Linda Miner, et al., Practical Predictive Analytics and Decisioning Systems for Medicine, Academic Press.
- 3 John D. Kelleher, Brian Mac Namee, Machine Learning for Predictive Data Analytics, MIT Press.

Web Resources

1. <https://nptel.ac.in/courses/106104189>
2. <https://nptel.ac.in/courses/106106142>
3. <https://nptel.ac.in/courses/1061050>

BCA603T	Professional Elective – VII C)Web Programming VII (using Git & Git Hub)	3L:0T:0P	3 Credits
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Course Objectives

CO1: Understand the basics of version control and Git commands.

CO2: Use GitHub for creating and managing repositories and projects.

CO3: Apply Git and GitHub tools for project sharing and collaboration.

CO4: Develop and host simple web projects using GitHub Pages.

Course Content:

Unit I: Introduction to Git

Introduction to Version Control, Basics of Git, Installing Git, Git Configuration, Creating Repository, Basic Git Commands, Saving Project Files using Git.

Unit II: Working with GitHub

Introduction to GitHub, Creating GitHub Account, Creating Repository, Uploading Files and Projects, Cloning Repository, Push and Pull Operations.

Unit III: Project Management using GitHub

Managing Project Files, Updating Projects, GitHub Interface, Sharing Projects using GitHub, Introduction to Branches, Simple Collaboration Basics.

Unit IV: Hosting and Portfolio Development

Introduction to GitHub Pages, Hosting Simple Website on GitHub, Creating Student Portfolio Repository, Best Practices for Project Documentation and Version Control.

Text Books

1. Anna Skoulkari, “Learning Git”, O’Reilly Publications.
2. Jon Loeliger and Matthew McCullough, “Version Control with Git”, O’Reilly Publications.

Reference Books

1. Prem Kumar Ponuthurai and Jon Loeliger, “Version Control with Git”, O’Reilly Publications.
2. Jon Duckett, “HTML and CSS: Design and Build Websites”, Wiley Publications.

Web Resources

4. <https://git-scm.com/doc>
5. <https://github.com/>
6. <https://nptel.ac.in/courses/106105084>

BCA603P	Professional Elective VII Lab A)Exploratory Data Analysis Lab	0L:0T:4P	2 Credits
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Lab Experiments:

1. Dataset importing using Pandas
2. Handling missing values
3. Statistical summary generation
4. Histogram and boxplot creation.
5. Correlation heatmap generation
6. Scatter plot analysis
7. Outlier detection
8. Time-series plotting
9. Mini project on real dataset
10. EDA report preparation

BCA603P	Professional Elective-VII Lab B)Predictive Analysis	0L:0T:4P	2 Credits
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Lab Experiments:

1. Data preprocessing using Pandas
2. Linear regression implementation
3. Logistic regression model
4. Decision tree classifier
5. KNN classification
6. Time-series forecasting
7. Outlier detection
8. Model accuracy comparison
9. Feature engineering experiment
10. Mini predictive analytics project

BCA603P	Professional Elective – VII Lab C)Web Programming VII (using Git & Git Hub) Lab	0L:0T:4P	2 Credits
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1. Install Git software and configure username and email.
2. Create a local Git repository using git init command.
3. Add and commit files using git add and git commit commands.
4. Check project status and commit history using git status and git log.
5. Create a GitHub account and create a remote repository.
6. Upload local project files to GitHub using push command.
7. Clone a GitHub repository to local system using git clone.
8. Update project files and synchronize changes using pull and push commands.
9. Create and switch simple branches in Git repository.
10. Host a simple HTML web page using GitHub Pages.

BCA604T	Soft Skills	0L:1T:0P	1 Credit
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Course Objectives

- CO1: Understand the importance of soft skills and effective communication in professional life.
- CO2: Develop professional communication skills including resume writing, presentations, and e-mail writing..
- CO3: Apply interview, personality development, and group discussion skills for career growth.
- CO4: Demonstrate leadership, teamwork, time management, and workplace ethics in professional environments.

Course Content:

UNIT I: Introduction to Soft Skills and Communication

Soft Skills vs Hard Skills, Importance of Soft Skills in Professional Life, Interdisciplinary Relevance of Soft Skills, Verbal and Non-Verbal Communication, Listening Skills and Fundamentals of Good Listening, Professional Etiquette and Interpersonal Communication.

UNIT II: Professional Communication Skills

Resume and Curriculum Vitae, Types of Resume: Chronological, Functional and Hybrid , Job Application and Cover Letter, E-mail Writing, Technical Writing Basics, Professional Presentation: Planning, Preparation and Delivery.

UNIT III: Personality Development and Interview Skills

Personality Development Concepts, Interview Skills and Preparatory Steps for Interviews, Types of Interviews, Group Discussion: Importance and Types, Difference between Group Discussion, Panel Discussion and Debate, Personality Traits Evaluated during Group Discussions

UNIT IV: Leadership and Team Building Skills

Leadership Skills and Qualities, Team Building and Collaboration, Time Management Skills, Stress Management Techniques, Conflict Resolution Skills, Workplace Ethics and Professionalism, Motivation and Self-Confidence Development, Adaptability and Positive Attitude

Text Books

1. Soft Skills-An integrated approach to maximize personality R. Gajendra Singh Chauhan, Sangeeta Sharma ISBN: 987-81-265-5639-7, First Edition 2016

Reference Books

1. English grammar and Composition, Wiley Wren and Martin, S.Chand publications
2. A modern approach to verbal reasoning, R. S. Aggarwal, S.Chand publications

Web Resources

1. <https://nptel.ac.in/courses/109104115>
2. <https://nptel.ac.in/courses/109105110>
3. <https://nptel.ac.in/courses/109107121>
4. <https://nptel.ac.in/courses/110107147>

BCA605P	Major Project	0L:0T:8P	4 Credit
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Course Objectives:

To enable students to integrate theoretical and practical knowledge in Information Technology.

To develop teamwork, planning, execution, analytical, and troubleshooting skills.

To enhance students' ability to write technical reports, conduct literature surveys, and perform requirement and system analysis.

Project Guidelines:

Project Group Formation:

- Each major project group shall consist of 4 members, with equal participation from all team members.
- The project should focus on innovation and real-world problem solving, avoiding direct duplication of existing projects.
- Students must perform a Literature Review to study existing systems, research papers, and identify research gaps or limitations.
- Every project must include a clear Problem Statement, objectives, and a properly developed working model/prototype.
- The project should be completed within the stipulated timeline, following stages such as planning, development, testing, and review.
- Each group must submit a well-structured Project Report and present the project through final demonstration and viva evaluation.

Requirement Analysis:

- Detailed analysis of the requirements for the project.
- Identification of functional and non-functional requirements.

System Analysis:

- Development of Data Flow Diagrams (DFD) up to Level 2.
- Identification of system inputs, outputs, processes, and data storage.

System Design:

- Drafting the architecture of the system or application being developed.
- Creation of system design models, including HLD (High-Level Design) and LLD (Low-Level Design), if applicable.
- Coding/Implementation (30-50% Completion):
- Initial coding and development of the system/application.
- Implementation of core functionalities based on the system design.

Assessment and Evaluation:

- Weekly progress meetings with the project guide to discuss advancements and challenges.
- Continuous assessment of project work on a weekly basis by the guide.
- Submission of progress reports documenting the development stages, challenges faced, and solutions applied.

Project Support:

- Regular interaction with the assigned project guide for guidance through various project activities.
- Encouragement of teamwork through collaborative discussions and problem-solving sessions week.
- Access to necessary resources, tools, and equipment project completion.

Expected Outcomes:

- A functional prototype system/application that addresses the defined problem.
- A comprehensive technical documenting the process, findings, and conclusions of the project.
- Enhanced skills in teamwork, communication, project management, and technical writing.

Important Notes:

Groups should choose topics that challenge and align with their interests in Information Technology. should be realistic in scope and achievable within the semester timeframe- Students are encouraged to leverage online resources, industry contacts, faculty expertise as needed
