



MANGALORE UNIVERSITY

State Education Policy – 2024
[SEP-2024]

CURRICULUM

FOR

**BCA-ARTIFICIAL INTELLIGENCE
AND MACHINE LEARNING**

MANGALORE UNIVERSITY

Suggested programme structure for the Undergraduate Programmes

[BCA, BCA (A.I & M.I), BCA (D.A)]

Sem	Course 1	Course 2	Course 3	Elective / Optional	Course	Language	Compulsory	Total Credit	Total Working hour
I	5 (3T+2P)	5 (3T+2P)	5 T			3+3	2	23	4+4+4+4+5+4+ 4+2=31
II	5 (3T+2P)	5 (3T+2P)	5T			3+3	2	23	4+4+4+4+5+4+ 4+2=31
III	5 (3T+2P)	5 (3T+2P)	5T	2		3+3		23	4+4+4+4+5+4+ 4+2=31
IV	5 (3T+2P)	5 (3T+2P)	5T	2		3+3	2	25	4+4+4+4+5+2+ 4+4+2=33
V	<u>8[(2x3T)+2P]</u>	<u>8[(2x3T)+2P]</u>	<u>8[(2x3T)+2P]</u>				2	26	3+3+3+3+3+3+ 4+4+4+2=32
VI	3T+2P	3T+2P	Research Methodology + Project Work- 12					22	3+3+4+4+22=36
Total Credits									142

Note:

- Course1 and Course2: I to IV Semester: Theory 3 credits = 4 contact hours and Practical 2 credits=4 contact hours
- Course 3: I to IV Semester: Theory 5 credits = 5 contact hours
- Course1, Course2 and Course3: V and VI Semester: Theory 3 credit=3 contact hours and Practical 2 credits =4 contact hours
- Elective/Optional: 2 credits=2 contact hours
- Languages: 3 credits=4 contact hours
- Compulsory: 2 credits=2 contact hours

Curriculum Structure

Semester V								
Sl. No	Course Code	Title of the Course	Category of Courses	Teaching Hours per Week	SEE	IA	Total Marks	Credits
1	BCAAIMS501	Machine Learning Techniques	Core	3	80	20	100	3
2	BCAAIMS502	Web Application Development using PHP and MySQL	Core	3	80	20	100	3
3	BCAAIMS503	Statistical Analysis and Data Visualization Using R	Core	3	80	20	100	3
4	BCAAIMS504	Internet Of Things	Core	3	80	20	100	3
5	BCAAIMS505	Advanced Artificial Intelligence	Core	3	80	20	100	3
6	BCAAIMS506	Natural Language Processing	Core	3	80	20	100	3
7	BCAAIPS507	Web Application Development Lab	Practical	4	40	10	50	2
8	BCAAIPS508	Statistical Analysis and Data Visualization Lab	Practical	4	40	10	50	2
9	BCAAIPS509	Machine Learning and IoT Lab	Practical	4	40	10	50	2
10	BCAAISS501	AI Tools and Techniques	Compulsory	2	40	10	50	2
Total				32	640	160	800	26

Semester VI								
Sl · No	Course Code	Title of the Course	Category of Courses	Teachin g Hours per Week	SEE	IA	Total Marks	Credits
1	BCAAIMS601	Artificial Neural Network	Core	3	80	20	100	3
2	BCAAIMS602	Computer Vision	Core	3	80	20	100	3
3	BCAAIPS603	Artificial Neural Network Lab	Practical	4	40	10	50	2
4	BCAAIPS604	Computer Vision Lab	Practical	4	40	10	50	2
5	BCAAIPS605	Research Methodology and Project Work	Project Work	22	400	100	500	12
Total				36	620	180	800	22

SEMESTER V

Program Name	BCA (AI – ML)	Semester	V
Course Title	Machine Learning Techniques (Theory)		
Course Code:	BCAAIMS501	No. of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes:

At the end of the course the students will be able to

1. Identify machine learning techniques suitable for a given problem.
2. Solve the problems using various machine learning algorithms
3. Apply data processing techniques
4. Apply the design of intelligent machines
5. Evaluate different clustering techniques

Unit	Description	Hours
I	Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Evaluation, Model Prediction, Search and Learning.	09
II	Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.	10

III	Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias-Variance Trade-off, Random Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification , Class Conditional Independence and Naive Bayes Classifier (NBC).	10
IV	Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization , Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering. Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression.	10

Textbook:

1. M N Murty and Ananthanarayana V S., “ Machine Learning : Theory and Practice”, Universities Press. 2024
2. S Sridhar and M Vijayalaxmi, “Machine Learning”, Oxford University Press.

Reference Books:

1. Mark E Fenner., “ Machine Learning with Python for Everyone”, Pearson Publishers. 2020
2. Abdul Hamit Subasi.,”Practical Machine Learning for Data Analysis Using Python”
3. John Hearty “Advance Machine Learning with Python”.
4. Sebastian Raschka and Vahid Mirjalili. "Python Machine Learning: Machine Learning and Deep Learning with Python, Scikit-Learn, and Tensor Flow”, Packt 2019.
5. Aurélien Géron."Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"
6. Andreas C. Müller, Sarah Guido., "Introduction to Machine Learning with Python". O'Reily Publishers

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	BCA-AIML	Semester	V
Course Title	Web Application Development using PHP and MySQL (THEORY)		
Course Code:	BCAAIMS502	No. of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the basics of PHP and MySQL, including their roles in web development.
- Write and execute PHP scripts to create dynamic web pages.
- Use PHP sessions and cookies to manage state and user information.
- Understand the fundamentals of JavaScript, including its syntax and data types.
- Write and execute JavaScript code to create interactive web pages.

Unit	Description	Hours
I	Basics of HTML, Overview and features of CSS3. Animation: Introduction, Start and End States, Interpolation, Animations in HTML. All About CSS Animations, creating a Simple Animation, Detailed Look at the CSS Animation Property, Keyframes, Declaring Multiple Animations, Wrap-up. All About CSS Transitions, Adding a Transition	09

II	Introduction to PHP: Introduction to PHP, History and Features of PHP, Understanding PHP, Writing Comments in PHP, Sending Data to the Web Browser, Data types in PHP, Keywords in PHP, Using Variables, Constants in PHP, Expressions in PHP, Operators in PHP, Conditional statements: if, if-else, switch, The ? Operator, Looping statements: while Loop, do-while Loop, for Loop.	10
III	Arrays in PHP: Creating Arrays, Accessing Array elements, Indexed v/s Associative arrays, Multidimensional arrays, using Array Functions. Functions in PHP, Function definition, Creating and invoking user-defined functions, Formal parameters versus actual parameters, Function and variable scope. Strings in PHP: What is String? Creating and Declaring String, String Functions. Classes and Objects in PHP: Creating and accessing a Class & Objects, Object properties, object methods.	10
IV	Form Handling: Creating HTML Form, Handling HTML Form data in PHP Database Handling using PHP with MySQL: Introduction to MySQL, Database terms, Data Types, Accessing MySQL using MySQL Client and Using phpMyAdmin, MySQL Commands, Using PHP with MySQL, PHP MySQL Functions, Connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Inserting, deleting and Updating Records with PHP.	10
Textbooks: 1. Animation in HTML, CSS, and JavaScript, Kirupa Chinnathambi, 1st Edition, CreateSpace Independent Pub, 2013. 2. Kevin Tatroe, Peter MacIntyre and Rasmus Lerdorf, Programming in PHP, 3rd Edition O'Reilly Publications 3. Robin Nixon, Learning PHP, My SQL, JavaScript, CSS and HTML5, 3rd Edition, O'Reilly Publications		

4. Larry Ullman, PHP and MySQL for Dynamic Websites 5th Edition
Peachpit Press

Reference Books:

5. Deitel, Paul_Deitel, Harvey_Deitel, Abbey - Internet and World Wide Web How to Program-Pearson Education (US) (2011)
6. Steven Holzner, PHP the Complete Reference
7. Chris Bates - Web Programming_ Building Internet Applications-Wiley (2002)
8. Web Programming with HTML5, CSS, and JavaScript-John Dean
9. **Complete Set of Scripts and SQL Commands:**
<https://github.com/LarryUllman/phpmysqlvqp-5ed>

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	BCA-AIML	Semester	V
Course Title	Statistical Analysis and Data Visualization Using R (THEORY)		
Course Code:	BCAAIMS503	No. of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes:

After successful completion of this course, the students will be able to:

1. Demonstrate proficiency in R programming concepts including data types, vectors, matrices, arrays, lists, data frames, file handling, functions, conditional statements, loops, and exception handling.
2. Develop and interpret graphical representations and data visualizations using R and ggplot2
3. Apply descriptive statistical techniques to analyse ungrouped and grouped data
4. Analyse relationships between variables using correlation and regression techniques and interpret statistical results for decision-making and predictive analysis.

Unit	Description	Hours
I	Introduction of the language: Numerics, Arithmetic, Assignment, and Vectors, Matrices and Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Reading and Writing Files. Programming Basics: Calling Functions, Conditions and Loops, Writing Functions Exceptions, Timings, and Visibility.	09

II	Plotting Basics and Basic Data Visualization: Using plot with Coordinate Vectors, Graphical Parameters, Automatic Plot Types, Title and Axis Labels, Line and Point Appearances, Plotting Region Limits, Adding Points, Lines and Text to an Existing Plot. The ggplot2 Package, A Quick Plot with qplot, Bar plots and Pie Charts, Building a Bar plot, A Quick Pie Chart, Histograms, Scatterplots.	08
III	Data Measurement: Types of Data, Nominal, Ordinal, Scale and Ratio. Descriptive Statistics: Measures of Central Tendency: Ungrouped Data: Mode, Median, Mean, Percentiles, Quartiles Measures of Variability: Ungrouped Data: Range, Interquartile Range, Mean Absolute Deviation, Variance, and Standard Deviation, Mean Absolute Deviation, Variance, Standard Deviation, z Scores, Coefficient of Variation. Measures of Central Tendency and Variability: Grouped Data: Measures of Central Tendency, Mean, Median, Mode, Measures of Variability Measures of Shape: Skewness and the Relationship of the Mean, Median, and Mode, Coefficient of Skewness. Distributions: Binomial, Poisson, Continuous Probability Distribution, Normal Distribution, Uniform Distribution. Estimating the population mean using the t-distribution.	12
IV	Statistical Inference and Hypothesis Testing: Types of Hypotheses, and Sample, Null and Alternate Hypothesis, Level of Significance, Type I and Type II Errors, One Sample t-test, Chi Square Test of Independence, One way ANOVA. Correlation and	10

	Regression: Analysis of Relationship, Positive and Negative Correlation, Perfect Correlation, Karl Pearson Coefficient of Correlation, Correlation Matrix, Scatter Plots, Simple Regression Analysis.	
Text Books: 1. Tilman M. Davies, “The book of R: A first course in programming and statistics”, San Francisco, 2016. 2. Ken Black, Business Statistics, New Delhi, Wiley, 2013. Reference Books: 1. Vishwas R. Pawgi, “Statistical computing using R software”, Nirali Prakashan publisher, 2022. 2. Garrett Grolemond “Hands-On Programming with R” Oreily Publications.		

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	BCA-AIML	Semester	V
Course Title	Internet Of Things(THEORY)		
Course Code:	BCAAIMS504	No.of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes

After successful completion of the course, students will be able to:

1. Explain the fundamental concepts of IoT, including its evolution, applications, impact, challenges, and the convergence of Information Technology (IT) and Operational Technology (OT).
2. Analyse IoT network architectures and design principles considering scalability, security, constrained devices and networks, data management, and legacy device integration, including the oneM2M standardized architecture.
3. Describe and apply the core IoT functional stack, including sensors and actuators, communication networks, gateways, network management, applications, analytics, and IoT data management using edge, fog, and cloud computing.
4. Evaluate and select suitable IoT communication technologies based on range, frequency, power consumption, topology, data rate, latency, security, and other communication requirements, with emphasis on IEEE 802.15.4 and related technologies.
5. Explain and implement IoT networking and application-layer protocols, including IPv6, 6LoWPAN, RPL, CoAP, and MQTT, for connecting constrained smart objects and enabling efficient IoT communication.

Unit	Description	Hours
I	Introduction to IoT: What Is IoT? Genesis of IoT, IoT and Digitization, IoT Impact- Connected Roadways, Connected Factory, Smart Connected Buildings, Smart Creatures, Convergence of IT and OT, IoT Challenges. IoT Network Architecture and Design: Drivers Behind New Network Architectures- Scale, Security, Constrained Devices and Networks, A Simplified IoT Architecture.	09
II	The Core IoT Functional Stack: Layer 1: Things: Sensors and Actuators Layer. Layer 2: Communications Network Layer Access Network Sublayer, Gateways and Backhaul Sublayer, Network Transport Sublayer, IoT Network Management Sublayer. Layer 3: Applications and Analytics Layer, Analytics Versus Control Applications, Data Versus Network Analytics, Data Analytics Versus Business Benefits, Smart Services.	10
III	Connecting Smart Objects: Communications Criteria-Range, Frequency Bands, Power Consumption, Topology, Constrained Devices, Constrained-Node Networks Data Rate and Throughput Latency and Determinism Overhead and Payload IoT Access Technologies IEEE 802.15.4 Standardization and Alliances Physical Layer MAC Layer Topology Security Competitive Technologies IEEE 802.15.4, Conclusions-IEEE 802.15.4g and 802.15.4e	10
IV	IP as the IoT Network Layer: The Business Case for IP, The Key Advantages of Internet Protocol Adoption or Adaptation of the Internet Protocol, IP Versions, Optimizing IP for IoT From 6LoWPAN to 6Lo, Header Compression Fragmentation. RPL: Objective Function (OF), Rank RPL Headers, Metrics. Application Protocols for IoT: IoT Application Layer Protocols CoAP Message Queuing Telemetry Transport (MQTT).	10

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Reference Books:

1. Raj Kamal, "INTERNET OF THINGS - Architecture and Design Principles" MGH, 2017
2. Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things - Key Applications and Protocols", Wiley Publishers.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	BCA-AIML	Semester	V
Course Title	Advanced Artificial Intelligence (THEORY)		
Course Code:	BCAAIMS505	No. of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Course Outcomes (COs):

1. Apply appropriate problem-solving strategies and search techniques to design intelligent agents that operate efficiently in deterministic and nondeterministic environments.
2. Analyze and implement probabilistic reasoning techniques including Bayesian networks and temporal models for decision-making under uncertainty.
3. Evaluate learning strategies including reinforcement learning and sequential decision-making methods to solve real-world decision problems.
4. Design machine learning models using supervised learning techniques such as decision trees, regression, and neural networks to make predictions and classifications.

Unit	Description	Hours
I	Solving Problems by Searching: Problem-Solving Agent - Problem formulation, searching solutions and executing actions. Measuring Problem-Solving Performance -Completeness, Optimality, Time complexity, Space complexity. Search in Complex Environments: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions.	10
II	Uncertain Knowledge: Uncertainty - Quantifying uncertainty - Acting under uncertainty – basic probability notation – inference using full joint	10

	distributions – independence - Bayes’ rule and its use.	
III	Reinforcement Learning: Basics of Reinforcement learning–Active and Passive reinforcement learning–Generalization–Applications of Reinforcement Learning. Making simple decisions: combining beliefs and desires – The basis of utility theory – Utility functions – multi attribute utility functions – decision networks – The value of information, Decision Networks.	10
IV	Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees. Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Linear Regression and Classification.	09
Textbooks: 1. Russell, S. & Norvig, P. (2021) Artificial Intelligence: A Modern Approach (4th ed.). Pearson Publishers Reference Books: 1. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning by James V Stone, Sebtel Press, 2019. 2. Artificial Intelligence by Example: Acquire advanced AI, machine learning, and deep learning design skills by Denis Rothman, 2nd Edition, 2020. 3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.		

Program Name	BCA-AIML	Semester	V
Course Title	Natural Language Processing (THEORY)		
Course Code:	BCAAIMS506	No. of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

COURSE OUTCOMES:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammar.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems.
3. Able to manipulate probabilities, construct statistical models over strings and trees
4. Will be able to estimate parameters using supervised and unsupervised training methods.
5. Able to design, implement, and analyze NLP algorithms. Able to design different language modeling Techniques.

Unit	Description	Hours
I	Natural Language processing (NLP) : Introduction, Applications and Components of NLP, Finding the Structure of Words: Words and Their Components, Lexemes, Morphemes, Morphology, Problems in morphological processing, Natural Language Processing with python NLTK .	10
II	Text Preprocessing Tasks: Word Tokenization, Sentence Tokenization, Filtering Stop words, Term Frequency- Inverse Document Frequency (TF-IDF). Only concepts of Stemming, Lemmatization, Parts of	10

	Speech tagging, Named Entity Recognition.	
III	Text Representation Techniques: Basic Representations - Bag-of-Words (BoW), TF, TF-IDF; Limitations, One-hot Encoding vs. Dense Representations; Word Embeddings - Word2Vec, GloVe, FastText; Limitations; Contextual Embeddings - BERT, GPT.	10
IV	NLP Tasks and Classical Models: Language Modeling - n-gram models, Laplace Smoothing; Text Similarity and Clustering; Topic Modeling - LDA; Text Classification - Sentiment Analysis, Spam Detection; Part-of-Speech (POS) Tagging.	09
TEXTBOOKS: 1. Multilingual natural Language Processing Applications: From Theory to Practice–Daniel M. Bikel and Imed Zitouni, Pearson Publication. 2. Speech and Natural Language Processing–Daniel Jurafsky & James H Martin, Pearson Publications. REFERENCE BOOKS: 1. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary.		

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	BCA-AIML	Semester	V
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Course Title	Web Application Development Lab		
Course Code:	BCAAIPS507	No. of Credits	02
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

List of Practical Exercises to be carried out by the students:

PART – A

- 1.Design a HTML5 web page containing a form with text, number, option button, list box with multiple select, email, URL, file, submit and reset elements which must be styled using CSS3 according to any one of the following screenshots or similar.

The image displays two examples of web forms. The left form, titled 'Biodata Application Form', includes fields for Full Name, Email Address, Date of Birth, Age, Phone Number, LinkedIn Profile URL, Gender, Highest Qualification, Key Skills, Residential Address, Upload Resume, and Declaration. The right form, titled 'CREATE ACCOUNT', includes fields for Full name, Email address, Personal website, Password, Age, Experience level, and Profile photo.

- 2.Design and implement a web page using HTML and CSS to create a box that performs multiple animations simultaneously.

3. Write a PHP program demonstrating the usage of sessions to store and retrieve user credentials like username and password. Combine the login, welcome, and logout functionalities into two files – 'index.php' and 'welcome.php'.

The screenshot shows a web interface with two main sections. On the left, under the heading "Login", there is a form with two input fields: "Username:" and "Password:". Below the "Password:" field is a button labeled "Login". On the right, under the heading "Welcome user2", there is a message "This is a secure area. You're logged in." and a link labeled "Logout" in purple text.

4. Write a PHP program with a user interface for calculating the number of days between two given dates. Display the difference in years, months, and days.

The screenshot shows a web interface for calculating the difference between two dates. It has two rows of date pickers. The first row is for the "Start Date" and is set to "May 13 2026". The second row is for the "End Date" and is set to "Jul 21 2027". Each date picker consists of a month dropdown, a day dropdown, and a year input field, followed by a small calendar icon. Below the date pickers is a checkbox labeled "include end day (add 1 day)". At the bottom is a large green button labeled "Calculate" with a play icon.

5. Write a PHP script to create gif, jpeg and png images with text and display those images in a html webpage.
6. Write a PHP program to create an associative array representing a dictionary with words as keys and their meanings as values. Allow users to input a word and display its meaning if found, otherwise, display a "Word not found" message. (Please keep 10 pairs of keys and their meanings)

Dictionary

Enter a word:

Meaning: A fruit that grows on trees.

Dictionary

Enter a word:

Word not found.

7. Write a PHP program that includes a user form with a text field and submit buttons for various string manipulations. It will display the result accordingly. (for replace, replace 'a' with 'x').

String Manipulation

Enter a string:

Shuffled string: niLda

PART – B

1. Create a PHP webpage for an **Online Product Gallery** that displays product cards with images, product name, price, and description fetched using PHP variables or arrays. Apply **CSS transitions and transformations** so that when the user hovers over a product card:
 - a) The card smoothly enlarges
 - b) Rotates slightly
 - c) Changes its shadow and opacity
 - d) The image zooms in with different timing functions
2. Create a PHP program to implement an **Employee Information Form** using Labels, Text Boxes, Text Area, Checkboxes, Radio Buttons, Select Menu, and Submit Button.

The form should collect the following details: Employee ID, Employee Name, Department, Address, E-Mail, Mobile Number, Gender, Skills Known, Salary Range and Date of Joining. After submitting the form, display all the user-entered details on a new PHP page in a well-formatted table or card layout using PHP.

3. Write a PHP program that implements a class to add and find the difference of two distance values given in feet and inches. The user inputs are collected through an HTML form.

Distance Calculator

Distance 1:
Feet:
Inches:

Distance 2:
Feet:
Inches:

Results:

Sum: 9' 5"

Difference: 5' 8"

4. Program to implement a login form where users enter their username and password. Validate the credentials against data stored in a MySQL database and grant access if they are correct.
5. Program to create a feedback form with fields for name, email, subject, and message. Store the submitted feedback data in a MySQL database for later review.
6. Create a PHP-MySQL application for a Student Attendance Management System. Create a MySQL database and a table to store student attendance details such as Student USN, Student Name, Class, Subject, Attendance Percentage, Attendance Status. Design a webpage using HTML and CSS to input the above fields. Apply appropriate CSS styling and validation for input fields. Use PHP to establish a connection with the MySQL database, insert student attendance details into the database table, fetch and display all

records in a formatted table. Provide options to Save Record, Clear Form and View Attendance Details.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic :5 Marks Execution: 5 Marks	15 Marks
Program-2	PART-B Writing: 5 Marks; Logic:10 Marks Execution: 5 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	V
Course Title	Statistical Analysis and Data Visualization Lab		
Course Code:	BCAAIPS508	No.of Credits	02
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

List of Practical Works to be carried out:

PART-A

- Write a program to create a 3 X 3 matrices A and B and perform the following operations
 - Add, subtract, multiply and divide(corresponding elements $\frac{a_{ij}}{b_{ij}}$) the two matrices.
 - Find the Inverse and Transpose of Matrix A
 - Add a row and a column to Matrix B using rbind() and cbind()
 - Find the size, number of rows, number of columns and number of elements of Matrix A
 - Modify the diagonal elements of Matrix B.
- Write a R program to print the multiplication table of a given number using a for loop
- Write an R program to create a list containing strings, numbers, vectors and logical values and do the following manipulations over the list
 - Access the first element in the list
 - Give the names to the elements in the list
 - Add element at some positions in the list
 - Remove the element

- e) Print the first and third element
 - f) Update the third element
4. a) Construct a histogram of grouped data and superimpose a frequency polygon on the histogram for the given frequency table:

C.I	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	4	8	11	15	12	6	3

- b) The actual outlay on the public health sector in the 7th and 8th five-year plan of India is shown below:

Heads	7thplan	8thplan
Agriculture and Allied services	30317	32025
Irrigation and flood control	16719	23771
Industries and minerals	30052	46889
Transport and communication	38804	80798
Energy	63615	122356
Services	39576	84088
Miscellaneous	3186	44173

Draw pie chart to show the relative importance attached to various heads in each plan

5. Write an R program to create a Data Frame with following details and do the following operations.

ItemCode	itemCategory	ItemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

- a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
 - b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies”
 - c) Subset the Data frame and display the items where the Itemprice between 300 and 700
 - d) Compute the sum of all ItemPrice
 - e) Create another Data Frame called “item-details” with three different fields ItemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames.
6. Create a factor marital_status with levels Married, single, divorced. Perform the following operations on this factor
- a) Check the variable is a factor
 - b) Access the 2nd and 4th element in the factor
 - c) Remove third element from the factor
 - d) Modify the second element of the factor
 - e) Add new level widowed to the factor and add the same level to the factor marital_status
7. Write R language Scripts for following operations on Iris Data Set
- a) Load the Iris Dataset
 - b) View first six rows of iris dataset
 - c) Summarize iris dataset
 - d) Display number of rows and columns
 - e) Display column names of dataset.
 - f) Create histogram of values for sepal length
 - g) Create scatterplot of sepal width vs. sepal length
 - h) Create boxplot of sepal width vs. sepal length
 - i) Find Pearson correlation between Sepal.Length and Petal.Length
 - j) Create correlation matrix for dataset

PART-B

Note: Implement Using R Script and Solve Manually

1. Write a R program to create a Vector containing following 8 values and perform the following operations.

4	3	0	5	2	9	4	5
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- a) Find mean, median, mode.

- b) Find the range.
- c) Find the 35th and 78th percentile.
- d) Find the variance and standard deviation
- e) Find the interquartile range.
- f) Find the z-score for each value.

[R Script: 5 Marks Manual Solution: 7 Marks]

2. Write R script to find the correlation coefficient and type of correlation between advertisement expenses and sales volume using Karl Pearson's coefficient of correlation method (Direct Method).

Firm	1	2	3	4	5	6	7	8	9	10
Advertisement Exp. (Rs. In Lakhs)	11	13	14	16	16	15	15	14	13	13
Sales Volume (Rs. In Lakhs)	50	50	55	60	65	65	65	60	60	50

[R Script: 5 Marks

Solution: 7 Marks]

3. Write R script to compute the regression equation of y on x from the following data. Predict the value of y when x=7.

X	2	4	5	6	8	11
Y	18	12	10	8	7	5

[R Script: 5 Marks

Solution: 7 Marks]

4. The times taken by a large group of students to complete a piece of homework, T minutes, are Normally distributed with a mean of 57 minutes and standard deviation of 6.5. Find the probability that the time taken by a random student from the group to complete this homework will be less than 60 minutes. Write R script to Find the probability that the time taken by a random student from the group to complete this homework
 - a) Will be less than 60 minutes
 - b) Between 50 and 80 minutes

[R Script: 6 Marks Manual Solution: 6 Marks]

5. Write R script to perform the following using binomial distribution
- If $n=4$ and $p=0.10$, find $P(x=3)$
 - If $n=12$ and $p=0.45$, find $P(5 \leq x \leq 7)$

[R Script: 6 Marks Manual Solution: 6 Marks]

6. Perform the following using uniform distribution between 200 and 240.
- $P(x > 230)$
 - $P(205 \leq x \leq 220)$

[R Script: 6 Marks Manual Solution: 6 Marks]

7. A company has three manufacturing plants, and company officials want to determine whether there is difference in the average age of workers at the three locations. The following data are the ages of five randomly selected workers at each plant. Perform a one-way ANOVA to determine whether there is a significant difference in the mean ages of the workers at three plants. Use $\alpha=0.01$. Write R script for the above problem.

	Plants		
Employee Age	1	2	3
	29	32	25
	27	33	24
	30	31	24
	27	34	25
	28	30	25

Assessment Criteria		
Program-1	PART-A : Writing: 5 Marks ; Logic: 5 Marks Execution: 5 Marks	15 Marks
Program-2	PART-B: Writing/Solving: 12 Marks Execution: 8 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	V
Course Title	Machine Learning and IOT Lab		
Course Code:	BCAAIPS509	No. of Credits	02
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

List of Practical Works to be carried out: (Note:Part B practicals can be carried out using either using hardware kits like NodeMCU, Arduino or RaspberryPi OR using Simulation softwares like Tinkercad)

PART-A

1. Assume a regression algorithm generates a model $y = 0.54 + 0.66x$ for data pertaining to week sales data of a product. Here, x is the week, and y is the product sales. Write Python Code to find the prediction for the 5th and 8th week. Also tabulate the Week wise Sales Prediction for a year. Visualize the sales prediction using Line Graph.

Sample Output:

Week	Predicted Sales

1	1.20
2	1.86
3	2.52
4	3.18
5	3.84
6	4.50
7	5.16

2. Write a Python Code to generate 100 values of x in the range $[0,1]$. let them be $x_1, x_2, x_3, \dots, x_{100}$. Perform the following on the data set generated.

- a. Label the first 50 points $\{x_1, x_2, \dots, x_{50}\}$ as follows: if $x_i \leq 0.5$ the x_i is member of Class - Lower Range else x_i is the member of class Upper Range.
 - b. Classify the remaining points $x_{51}, \dots, x_{100}$ using KNN. Perform this for 1,2,3,4,5,20,30.
3. Download the Olivetti Face dataset. There are 40 classes (corresponding to 40 people), each having 10 faces of individuals. So, there are 400 images in total. Here each face is viewed as an image of size $64 \times 64 = 4096$ pixels; each pixel having values 0 to 255 which are ultimately converted into floating numbers in the range $[0,1]$. Split the data set into train and test parts. Carry out this splitting repeatedly 10 times by varying train and test data set sizes and report the average accuracy. Perform the following tasks on the dataset.
 - a. Build a decision tree using the training data. Tune the parameters corresponding to pruning the decision tree. Use the best DT to classify the test data set and obtain accuracy. Use both Gini and Entropy impurities.
 - b. Build a Random Forest Classifier using the training data set. Use RF with 50 DTs. Obtain the classification accuracy on the test data with number of features as 20%, 40% and 60% of the given set of features.
4. Write a Python program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Write a Python program to implement k-Nearest Neighbor algorithm to classify the IRIS data set. Print both correct and wrong predictions.
6. Write a Python program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file.

PART-B

1. Design and build an Intrusion Detection System with Arduino and PIR Sensor
2. Design and develop an application that measures the room temperature and posts the temperature value on the cloud platform.

3. Design and develop an application to calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD.
4. Design and develop an application to upload humidity & temperature data to Thing Speak, periodically logging ambient light level to Thing Speak
5. Design and develop an application to interface a motor/bulb using relay with Arduino / Raspberry Pi and write a program to turn on motor/bulb when push button is pressed from the smartphone.
6. Design a traffic simulator with Arduino/Raspberry Pi.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic:5 marks Execution: 5 Marks	15 Marks
Program-2	PART-B Designing: 12 Marks Execution: 8 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	V
Course Title	Artificial Intelligence Tools and Techniques (Skill Based Practical Course - Compulsory)		
Course Code:	BCAAISS501	No.of Credits	02
Contact hours	26 Hours	Duration of SEA/Exam	--
Formative Assessment Marks	10	Summative Assessment Marks	40

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Identify and study different types of AI tools and their environments and develop various projects using them
2. Use the some of the current AI tools.

Q. No	Works to be carried by the students
1	Create an invitation (image format) for the College Annual Day Programme by giving appropriate prompts to AI Tools such as Gemini, ChatGPT, Adobe Firefly or Canva
2	Create a thirty second video story about a historical or mythological event using any video creation AI Tool
3	Create a Presentation about any topic using Gamma or NoteBookLM or any other Presentation creation AI Tools
4	Create a Lesson for 7 th Standard Science subject using Nearpod. Create at least five activities.
5	Create a static website with at least 10 pages using Claude, Caffeine, Gemini or Antigravity or any other Web Development AI Tool

6	Create a Shopping Cart web Application using Claude, Caffeine, Gemini or Antigravity or any other Web Development AI Tool
7	Create a dynamic web application which contains a mock test or a Quiz.
8	Create a mobile App using AI enabled Android Studio, Replit, Emergent or any other mobile App development AI Tools to detect a car, it's make, model and colour from an image.

Evaluation:

A printed report shall be prepared by the student under the guidance of the identified mentor/supervisor in the college and submitted to the Head of the Department for evaluation. The report shall be evaluated by the two internal faculty members and submit the summative marks to the university.

Scheme of valuation:

Internal Assessment	10 Marks (C1) Basis for Internal Assessment Continuous Evaluation: 10 Marks
Evaluation of Report	40 Marks (C2) i) Preparation and presentation: 25 Marks ii) Viva-Voce: 10 Marks iii) Record Book: 05 Marks

SEMESTER VI

Program Name	BCA-AIML	Semester	VI
Course Title	Artificial Neural Network(THEORY)		
Course Code:	BCAAIMS601	No. of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

Unit	Description	Hours
I	Introduction to Artificial Intelligence, Machine Learning, and Deep Learning. Types of Learning: Supervised and Unsupervised. Introduction to Artificial Neural Networks: Fundamentals of Neural Networks, Biological Neuron and Artificial Neuron. History and Evolution of Neural Networks. Characteristics and Applications of Neural Networks. Single Layer Perceptron: Basic Architecture, McCulloch-Pitts Neuron Model. Activation Functions: Binary Step, Linear, Sigmoid, Tanh, ReLU and Softmax. Limitations of Single Layer Perceptron.	10
II	Introduction to Multi-Layer Perceptron (MLP). Multi-Layer Neural Networks and Training: Multi-Layer Perceptron: Architecture of Multi-Layer Perceptron. Feed Forward Neural Networks. Forward and Backward Propagation. Error Calculation and Weight Update Mechanism.	09

III	Training Neural Networks: Training and Testing Datasets. Hyperparameters in Neural Networks. Batch, Stochastic and Mini-Batch Gradient Descent. Epochs and Iterations. Learning Rate and Momentum. Optimization and Regularization: Overfitting and Underfitting. Cross Validation. Regularization Techniques: Dropout and Early Stopping. Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score and Confusion Matrix.	10
IV	Deep Neural Networks: Introduction to Deep Learning. Deep Feed Forward Networks. Hidden Layers and Feature Extraction. Vanishing and Exploding Gradient Problems. Advanced Neural Networks and Applications: Recurrent Neural Networks: Introduction to Sequential Data. Recurrent Neural Networks (RNN). Working of RNN. Limitations of RNN. Introduction to LSTM and GRU. Applications in Text Processing. Emerging Neural Network Applications: Neural Networks in Natural Language Processing (NLP), Recommendation Systems, Generative AI.	10
TEXT BOOKS: 1. Charu C. Aggarwal “Neural Networks and Deep Learning” –, Springer. 2. Ian Goodfellow, Yoshua Bengio, Aaron Courville “Deep Learning” – MIT Press. 2016 3. Laurene V. Fausett “Fundamentals of Neural Networks” Prentice Hall. 1994 REFERENCE BOOKS: 1. B. Yegnanarayana “Artificial Neural Networks” – PHI Learning 1999.		

2. Simon Haykin., “Neural Networks: A Comprehensive Foundation” – Prentice Hall.
3. Aurélien Géron., “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow” 3rd Edition – O’Reilly Media.
4. François Chollet., “Deep Learning with Python” 2nd Edition 2021 – Manning Publications.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Quizzes/ Mini Projects/Group Discussion/ Experiential Learning.

Program Name	BCA-AIML	Semester	VI
Course Title	Computer Vision(THEORY)		
Course Code:	BCAAIMS604	No.of Credits	03
Contact hours	39 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

1. Course Outcomes: After completing this course, the student must demonstrate the knowledge and ability to:
2. Recognize and describe both the theoretical and practical aspects of image formation and computing with images.
3. Understand the basics of 2D and 3D Computer Vision and Connect issues from Computer Vision to Human Vision.
4. Become familiar with the significant technical approaches in computer vision, including registration, alignment, and image matching.
5. Get exposure to advanced concepts leading to object categorization and segmentation in images.
6. Build computer vision applications.
7. Implement computer vision applications using OpenCV, integrating machine learning algorithms for advanced tasks.

UNIT – I	9 Hours
Fundamentals of Image Processing and Computer Vision: Brief history of Computer Vision Image formation: Geometric primitives, 2D transformations, 3D transformations, 3D rotations, 3D to 2D projections, Lens distortions Photometric image formation- Lighting, Reflectance and shading. Camera projections: Sampling and aliasing	Book1: Page 29 to 91.
UNIT – II	10 Hours
Image processing Local operators -Pixel transforms, Colour transforms,	Book1: Page 97

Compositing and matting, Histogram equalization Neighbourhood operators- Linear filtering, Non-linear filtering, Morphology, Distance transforms, Connected components. Pyramids and wavelets: Interpolation and decimation, multi-resolution representations, Wavelets.	to 160
UNIT – III	10 Hours
Image Features and Recognition Techniques: Image Features, Image Descriptors, and Features, Texture Descriptors, colour Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform.	Book1: Page 203 to 253, Study Material
UNIT – IV	10 Hours
OpenCV and Applications of Computer Vision: Introduction to OpenCV and Applications of Computer Vision: What Is OpenCV? The Origin of OpenCV, Downloading and Installing OpenCV, First Program—Display a Picture, Second Program—AVI Video, A Simple Transformation OpenCV Primitive Data Types, CvMat Matrix Structure. Machine Learning Algorithms and their Applications in Medical, Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion, Programming Examples.	Book 3
TEXTBOOKS: 1. Computer Vision: Algorithms and Applications, Richard Szeliski, February 27, 2010 2. Computer Vision and Image Processing Manas Kamal Bhuyan CRC Press 1st Edition 2020 3. Gary Bradski and Adrian Kaehler. “Learning OpenCV: Computer Vision with the OpenCV Library,” First Edition, O’Reilly Media, 2008. 4. Computer Vision: A Modern Approach David A. Forsyth, Jean Ponce Pearson 2nd 2012 5. Machine Vision R. Jain, R. Kasturi, and B. G. Schunk McGrawHill 1995	

Program Name	BCA-AIML	Semester	VI
Course Title	Artificial Neural Networks Lab		
Course Code:	BCAAIPS603	No.of Credits	02
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

PART-A

1. Write a Python program to implement a single-layer Perceptron to determine attendance eligibility of students. Train the network using the Perceptron learning rule and test it with new attendance values. Display the eligibility status for each test input.
2. Write a Python program to implement a single-layer Perceptron to realize the OR logic gate. Display the final weights, bias, and predicted outputs.
3. Write a Python program to implement the LMS algorithm for identifying an unknown system defined by $d(n) = 0.5x(n) + 0.3x(n - 1)$ and plot the convergence.
4. Write a Python program to implement a Competitive Learning Neural Network for clustering two-dimensional input patterns.
5. Write a Python program to train a single-layer perceptron using given input patterns and plot the learning curve.
6. Using the learning rate annealing technique on $f(x) = x^2 + 4x + 4$, plot a graph showing learning the convergence.

PART-B

1. Write a Python program to implement the Perceptron learning algorithm with a step activation function and train it to classify the AND, OR, and XOR logic gates and plot the results.
2. Write a Python program to design and train a Multi-Layer Perceptron using TensorFlow/Keras for a simple classification problem.
3. Write a Python program to implement a single-layer neural network for the OR gate. Train the network using different activation functions. Compute the Mean Squared Error (MSE), and compare the performance of the activation functions
4. Implement a Hopfield Network in Python to store and recall multiple binary patterns. Test it with noisy inputs and visualize the energy convergence over iterations.
5. Write a Python program to implement a Self-Organizing Map (SOM) for clustering two-dimensional input data. Display the final neuron weight vectors representing clusters.
6. Write a Python program to demonstrate the Hopfield Network approach for solving a simple optimization problem such as the Traveling Salesman Problem (TSP) with a small number of cities.

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic:5 marks Execution: 5 Marks	15 Marks
Program-2	PART-B Writing: 5 Marks; Logic:10 marks Execution: 5 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	VI
Course Title	Computer Vision Lab		
Course Code:	BCAAIPS604	No.of Credits	02
Contact hours	52 Hours	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	10	Summative Assessment Marks	40

PART - A

1. Write a Python program using the OpenCV library to upload a digital image and perform operations related to image brightness enhancement, contrast adjustment, illumination variation. The program should display both the original and processed images.
2. Write a Python program to perform image translation, rotation, scaling, and shearing using OpenCV.
3. Write a Python program to Implement a simple image reconstruction technique from multiple projections using Radon Transform concepts.
4. Write a Python program to perform point processing operations such as image negative, thresholding, brightness enhancement, and contrast stretching.
5. Write a Python program to Implement smoothing and sharpening filters such as Mean Filter, Gaussian Filter and Median Filter
6. Write a Python program to Implement $RGB \leftrightarrow HSV$ and $RGB \leftrightarrow Grayscale$ image conversions and perform color enhancement and histogram equalization.

PART -B

1. Write a Python program to detect edges using Sobel and Prewitt edge detection algorithms.
2. Write a Python program to Develop a simple image classification system using Linear Regression.
3. Write a Python program to Build and train a CNN model using TensorFlow/Keras for handwritten digit or object classification.
4. Write a Python program to Create applications using OpenCV for Face detection and facial expression recognition.
5. Write a Python program to upload an image from the computer using File open dialog box and Implement Harris Corner Detection and extract basic image features.
6. Write a Python program to Create a simple real-time application such as Webcam edge detection

Evaluation Scheme for Lab Examination:

Assessment Criteria		
Program-1	PART-A Writing: 5 Marks; Logic:5 marks Execution: 5 Marks	15 Marks
Program-2	PART-B Writing: 5 Marks; Logic:10 marks Execution: 5 Marks	20 Marks
Practical Record		05 Marks
Total		40Marks

Program Name	BCA-AIML	Semester	VI
Course Title	Research Methodology and Project Work		
Course Code:	BCAAIPS605	No. of Credits	12
Contact hours	22 Hours/Week	Duration of SEA/Exam	3 Hours
Formative Assessment Marks	100	Summative Assessment Marks	400

PROJECT GUIDELINES

Preamble: The project work has been incorporated into the BCA programme to provide students with practical exposure to the design, development, and implementation of modern computing solutions. The primary objective of the project work is to enable students to understand and apply the principles of software engineering, problem-solving, innovation, and emerging technologies in real-world scenarios. During the development of the project, students are expected to actively participate in all phases of the Software Development Life Cycle (SDLC), including problem identification, requirements analysis, system design, development/coding, testing, deployment, documentation, and maintenance, with emphasis on building reliable, scalable, and user-oriented systems.

In view of rapid advancements in technology, students are encouraged to undertake projects in contemporary domains such as Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Internet of Things (IoT), Robotics, Drone Technology, Data Analytics, Cloud Computing, Cyber Security, Mobile Applications, and Web Technologies. AI/ML/DL projects may focus on intelligent systems, predictive analytics, automation, computer vision, natural language processing, or recommendation systems. IoT-based projects may involve sensor integration, smart automation, real-time monitoring, and connected devices. Robotics and Drone projects may include autonomous systems, embedded controllers, navigation, surveillance, industrial automation, or smart agriculture applications. Students may

also integrate hardware and software components wherever applicable to develop interdisciplinary and innovative solutions.

Since the project work spans the entire final semester, students are encouraged to select projects addressing the needs of industry, research organizations, startups, government agencies, or socially relevant real-life problems suggested by the faculty in charge of BCA project work in the institution. The selected project topic must be meaningful, analytical, application-oriented, and technically significant. It should demonstrate originality, creativity, and substantial development effort based on the chosen theme.

Use of ready-made, copied, off-the-shelf, pirated, or previously implemented work is strictly prohibited. Any form of plagiarism, fabrication, or use of unfair means shall result in rejection of the project work. All stages of project development must be carried out in a systematic and time-bound manner, and equal participation and contribution from all team members are expected throughout the project lifecycle.

GENERAL GUIDELINES TO THE INSTITUTIONS

- The Project Work Calendar shall be announced before the commencement of the VI Semester.
- The calendar shall include tentative schedules for:
 - Project Proposal Submission
 - Project Approval
 - Synopsis Submission
 - Problem Analysis Document
 - System Design Document
 - Database Design /Detailed Design
 - Coding and Testing
 - Project Demonstration and Internal Viva-Voce
 - Final Report Submission
- A project team shall consist of a maximum of four students. A project supervisor (from among the faculties of the institution) must be assigned for each team, before the commencement of the project work.
- Students shall undertake projects based on real-life, application-oriented, or research problems relevant to industry, society, or emerging technologies.
- Projects may be carried out within the institution or in collaboration with industries, research laboratories, startups, or

software companies, subject to approval by the faculty in charge/ project supervisor and the Head of the Department.

- The faculty in charge/ Project Supervisor shall ensure that industry-based projects are genuine, original, and academically relevant.
- Institutions shall conduct at least two Internal Assessment evaluations during the project period.
- Internal Assessment may include:
 - Project Presentations
 - Document Verification
 - Coding Demonstration
 - Viva-Voce
 - Group Discussion
 - Progress Review
- Internal Assessments shall evaluate the students' technical understanding, contribution, implementation skills, documentation, and overall project progress.

EVALUATION OF THE PROJECT

- Project evaluation shall be conducted jointly by one Internal Examiner and one External Examiner appointed by the University during the End Semester Examination.
- The examiners shall understand and follow the evaluation procedure, guidelines and marking scheme before commencement of the evaluation process.
- Each student in the project team shall individually present and explain their contribution to the project work.
- Evaluation shall include:
 - Project Demonstration
 - Viva-Voce
 - Technical Presentation
 - Verification of Documentation
 - Assessment of Individual Contribution
- Students shall demonstrate the working of the developed system, model, application, device, or prototype.
- For projects in domains such as Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Internet of Things (IoT), Robotics, Drone Technology, Data Analytics, and Embedded Systems, evaluation may include:
 - Dataset Preparation and Usage
 - Model Training and Testing

- Accuracy and Performance Metrics
 - Hardware Integration
 - Sensor/Device Connectivity
 - Real-Time Monitoring or Automation
 - Simulation or Prototype Demonstration
 - Innovation and Practical Relevance
- AI/ML/DL projects shall include proper validation of models using suitable evaluation metrics such as accuracy, precision, recall, F1-score, confusion matrix, or similar performance measures wherever applicable.
- IoT, Robotics, and Embedded System projects shall include demonstration of hardware functionality, communication protocols, device integration, and system reliability.
- If live demonstration is not possible due to confidentiality, copyright, licensing, cloud restrictions, or industry policies, students may present:
 - Screenshots
 - Recorded Demonstrations
 - Simulation Results
 - Deployment Reports
 - Performance Analysis
 - Technical Documentation
- In such cases, students shall submit valid supporting documents or authorization letters issued by the concerned organization or company.
- The evaluation shall primarily focus on:
 - Originality of the Work
 - Problem Identification and Solution Design
 - Technical Knowledge and Understanding
 - Implementation Skills
 - Innovation and Creativity
 - Testing and Validation
 - Documentation Quality
 - Practical Utility and Social/Industrial Relevance
- Examiners shall verify whether appropriate development methodologies and engineering practices have been followed throughout the project lifecycle.
- For software-based projects, adherence to Software Development Life Cycle (SDLC) principles shall be examined.
- For AI, ML, DL, IoT, Robotics, and interdisciplinary projects, suitable design, development, testing, deployment, and validation

practices relevant to the domain shall be considered during evaluation.

- Project evaluation shall be fair, objective, and based on the scope, complexity, originality, and outcomes of the project work.

SCHEME OF VALUATION and Marks Distribution

	Particulars	Marks
Internal Assessment		
	Progressive assessment for two times with award of 50 marks each time	100
Project Report Valuation (During End Semester Examination):		300
Viva-Voce: 100 marks		
1	Live Demonstration (Software execution) or Dry runs (Presentation of authentic screenshots or captured videos may be used to walk through complete scenarios)-consistency and completeness	80
2	Question and Answer (Oral)	20
Grand Total Marks		500

FORMAT OF PROJECT SYNOPSIS

The Project Synopsis is a concise summary of the proposed project work. It shall clearly present the objectives, methodology, technologies used, implementation plan, and expected outcomes of the project. The synopsis shall not exceed 20 pages.

The synopsis shall include the following:

1. Title of the Project
2. Introduction, Objectives, and Scope
 - Problem Statement
 - Objectives of the Project
 - Scope and Expected Outcomes
3. Project Domain/Category
 - Software Application
 - Web/Mobile Application
 - Database Management System
 - Client-Server System
 - Networking
 - Cloud Computing
 - Artificial Intelligence (AI)
 - Machine Learning (ML)

- Deep Learning (DL)
 - Internet of Things (IoT)
 - Robotics/Drone Technology
 - Data Analytics
 - Embedded Systems
 - Simulation/Game Development
 - Cyber Security
 - Any other relevant category
4. Tools, Platforms, and Requirements
- Programming Languages
 - Frameworks/Libraries
 - Development Tools and Platforms
 - Hardware Requirements
 - Software Requirements
 - Dataset Requirements (for AI/ML/DL projects)
 - Sensors/Controllers/Communication Modules (for IoT/Robotics projects)
 - Cloud or Deployment Requirements, if any
5. System Analysis and Design
- Architecture Diagram
 - DFD/UML/Class Diagrams/ER Diagrams/System Flowcharts as applicable
 - Database Design
 - Hardware Architecture (for IoT/Embedded/Robotics projects)
 - Model Architecture (for AI/ML/DL projects)
6. Project Structure and Methodology
- Module-wise Description
 - Functional Requirements
 - Data Structures/Algorithms Used
 - Process Flow and Logic
 - Training and Testing Methodology (for AI/ML/DL projects)
 - Communication Protocols and Device Interaction (for IoT projects)
 - Simulation/Prototype Details, if applicable
7. Testing and Validation
- Testing Methods and Tools
 - Performance Evaluation Metrics
 - Accuracy/Precision/Recall or other relevant measures for AI/ML projects
 - Reliability and Functional Testing for IoT/Robotics projects

8. Project Type

- Industry Defined
- Client Defined
- User Defined
- Research/Innovation Based

(Mention the name and address of the Industry/Client/Organization, if applicable.)

9. Limitations of the Project

10. Future Scope and Enhancements

11. References

- Books
- Research Papers
- Websites/APIs/Datasets/Documents referred to during project planning.

ORGANISATION OF THE DISSERTATION

The Dissertation Report shall be organized into clearly defined chapters and sections. The report shall present the complete development process, implementation details, testing, results, and conclusions of the project work. The structure may be adapted suitably depending on the project domain such as Software Development, AI, ML, DL, IoT, Robotics, Drone Technology, Embedded Systems, Data Analytics, or related interdisciplinary areas.

Sequence of Items in the Dissertation Report

- Cover Page (Hard Bound Cover)
- Title Page
- Certificate from the Institution
- Certificate from the Company/Industry (if applicable)
- Declaration by Students
- Acknowledgement
- Table of Contents
- List of Figures
- List of Tables
- List of Abbreviations and Acronyms
- Chapters
- Bibliography / References
- Appendices (if any)

CHAPTERS

1. Introduction

a. Project Overview

- Project Title
- Project Domain/Category
- Problem Statement
- Overview of the Proposed System
- b. Background Study
 - Organization/Industry Profile (if applicable)
 - Existing System and Limitations
 - Need for the Proposed System
- c. Objectives
 - Project Objectives
 - Expected Outcomes
- d. Scope of the Project
- e. System Architecture
 - Overall Architecture Diagram
 - Workflow/Process Flow
- f. End Users and Applications
- g. Tools and Technologies Used
 - Software Tools
 - Programming Languages
 - Frameworks/Libraries
 - Hardware Components (if applicable)
- h. Deployment Requirements
 - Hardware Requirements
 - Software Requirements
 - Network/Cloud Requirements

2. Software Requirement Specification (SRS)

- a. Introduction to SRS
- b. Overall Description
 - Product Perspective
 - Product Features and Functions
 - User Characteristics
 - Assumptions and Constraints
- c. Functional Requirements
 - Module-wise Functional Requirements
- d. Non-Functional Requirements
 - Performance
 - Security
 - Reliability
 - Scalability
 - Usability

- e. Special Requirements
 - Dataset Requirements (AI/ML/DL Projects)
 - Sensor/Device Requirements (IoT/Robotics Projects)
 - Communication Protocols
 - Cloud/API Requirements
- 3. System Design
 - Introduction to System Design
 - Functional Design
 - Functional Decomposition
 - Module Description
- c. Design Diagrams
 - Context Diagram
 - Data Flow Diagrams (DFD)
 - UML/Class Diagrams
 - Use Case Diagrams
 - Sequence/Activity Diagrams (if applicable)
- d. Architecture Design
 - Software Architecture
 - Hardware Architecture (for IoT/Embedded/Robotics Projects)
 - Model Architecture (for AI/ML/DL Projects)
- 4. Database Design / Data Design
 - a. Introduction
 - b. Database/Data Structure Design (For Web Application/ App Development Projects)
 - Table Definitions
 - ER Diagram
 - Schema Design
 - c. Data Collection and Preprocessing (For AI/ML/DL Projects)
 - Dataset Description
 - Data Cleaning
 - Feature Engineering
 - d. Sensor/Data Acquisition Design(For IoT/Robotics Projects)
- 5. Detailed Design and Methodology
 - a. Module-wise DesignFor each module:
 - Inputs
 - Process Logic/Algorithms
 - Outputs
 - Interfaces

- Implementation Details
 - b. Algorithms and Techniques Used
 - AI/ML Algorithms
 - Deep Learning Models
 - Data Processing Techniques
 - Control Logic/Automation Logic
 - c. Communication and Integration
 - API Integration
 - Device Communication
 - Cloud Connectivity
 - d. Structure Charts / Workflow
6. Implementation and Code Description
- a. Coding Structure
 - b. Important Code Modules
 - Authentication/Authorization
 - Database Operations
 - Data Processing
 - Search and Retrieval
 - API/Device Integration
 - Parameter Passing
 - Error Handling
 - Backup and Recovery
 - c. Model Training and Deployment
(For AI/ML/DL Projects)
 - d. Embedded/Hardware Programming
(For IoT/Robotics Projects)
 - e. Internal Documentation
7. User Interface and Outputs
- a. User Interface Screens
 - Login Page
 - Dashboard/Home Page
 - Data Entry and Management Screens
 - Reports and Visualizations
 - b. System Outputs
 - Reports
 - Graphs/Charts
 - Prediction Results
 - Alerts/Notifications
 - c. Prototype Demonstration (For IoT/Robotics/Drone Projects)

8. Testing and Validation
 - a. Introduction to Testing
 - b. Testing Methods
 - Unit Testing
 - Integration Testing
 - System Testing
 - Performance Testing
 - c. AI/ML/DL Validation
 - Accuracy
 - Precision
 - Recall
 - F1-Score
 - Confusion Matrix
 - Loss/Performance Analysis
 - d. IoT/Robotics Testing
 - Hardware Testing
 - Sensor Validation
 - Connectivity Testing
 - Reliability Testing
 - e. Test Reports and Results
9. Results and Discussion
 - Results Obtained
 - Performance Analysis
 - Comparison with Existing System
 - Interpretation of Outputs
10. Conclusion and Future Scope
 - Conclusion
 - Limitations
 - Future Enhancements and Scope

REFERENCES

- Books
- Research Papers
- Journals
- Websites
- APIs/Datasets
- Technical Documentation

APPENDICES (if any)

- Source Code
- User Manual
- Sample Outputs
- Installation Guide
- Published Papers/Certificates (if applicable)

Do not include any header or footer on any page of the report other than foot notes. Only page numbers should be mentioned at the bottom center of each page. 'n+1' copies of dissertation should be prepared by n number of candidates in the team.

DISSERTATION FORMAT

The dissertation shall be prepared in a clear, professional, and standardized format suitable for project works in Software Development, Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Internet of Things (IoT), Robotics, Drone Technology, Embedded Systems, Data Analytics, and related domains.

1. PAPER AND PRINTING FORMAT

1.1 Paper Quality

- The dissertation shall be printed on white A4 bond paper of minimum 70 GSM quality.
- Paper whiteness shall preferably be 95% or above.

1.2 Paper Size

- Standard A4 Size:
 - Height: 297 mm
 - Width: 210 mm

1.3 Printing and Font Specifications

- The dissertation shall be printed using LaserJet or Inkjet printers.
- Text shall be prepared using standard word processing software.

Recommended Formatting

- Font Style: Times New Roman/Bookman Old Style/ Book Antiqua / Adobe Garamond Pro
- Font Size:
 - Main Text: 12 pt
 - Chapter Titles: 18 pt Bold
 - Section Headings: 16 pt Bold
 - Subsection Headings: 14 pt Bold
- Line Spacing: 1.5

- Text Alignment: Justified

1.4 Margins

The following margins shall be maintained:

- Top Margin: 0.5 inch
- Bottom Margin: 0.5 inch
- Left Margin: 1 inch
- Right Margin: 0.75 inch

1.5 Pagination

- Page numbers shall be placed at the centre of the footer.
- Preliminary pages shall use lower-case Roman numerals (i, ii, iii, iv, ...).
- Main chapters shall use Arabic numerals starting from 1.

1.6 Length of Dissertation

- The dissertation shall normally contain a minimum of 60 pages excluding:
 - References
 - Appendices
 - Source Code Listings
 - Annexures
 - Questionnaires
 - Datasheets
- AI/ML/DL, IoT, Robotics, and Embedded projects may additionally include:
 - Dataset Samples
 - Model Architectures
 - Sensor Specifications
 - Hardware Schematics
 - Experimental Results
 - Performance Metrics

2. PARAGRAPH AND TEXT FORMAT

2.1 Paragraph Spacing

- A vertical spacing of approximately 2.5-line spaces shall be maintained between paragraphs.

2.2 Paragraph Indentation

- The first line of each paragraph may be indented by approximately 12 mm or 5 characters.
- Indentation may be omitted if adequate spacing between paragraphs is maintained.

2.3 Text Formatting Guidelines

- Avoid single-line paragraphs.

- Avoid leaving a single line at the top or bottom of a page (widows/orphans).
- Excessive hyphenation shall be avoided.

3. CHAPTER AND SECTION FORMAT

3.1 Chapter Format

- Each chapter shall begin on a new page.
- Chapter titles shall be centred and printed in 18 pt bold font.
- Chapters shall be numbered using Arabic numerals:
 - Example: Chapter 1, Chapter 2
- Adequate spacing shall be maintained:
 - Between chapter number and title
 - Between title and chapter content

3.2 Sections and Subsections

- Chapters may be divided into:
 - Sections
 - Subsections
 - Sub-subsections

Numbering Format

- Section: 2.1
- Subsection: 2.1.1

Formatting

- Section Headings:
 - 16 pt Bold
 - Left aligned
- Subsection Headings:
 - 14 pt Bold
 - Left aligned
- Further subdivisions may use smaller bold or italic fonts.

3.3 Table of Contents

The Table of Contents shall include:

- Chapters
- Sections
- Subsections
- Corresponding Page Numbers

4. TABLES, FIGURES, AND DIAGRAMS

4.1 General Guidelines

- Tables and figures shall preferably be in portrait orientation.
- Large figures or tables may be placed on separate pages.

4.2 Numbering

- Tables and figures shall be numbered chapter-wise.

Examples

- Table 3.2
- Fig. 5.4

4.3 Captions

- Table captions shall appear above the table.
- Figure captions shall appear below the figure.

4.4 Types of Figures

Depending on the project domain, figures may include:

- DFDs/UML Diagrams
- ER Diagrams
- Architecture Diagrams
- Flowcharts
- Neural Network Architectures
- Training Graphs
- Accuracy/Loss Curves
- IoT Block Diagrams
- Sensor Layouts
- Circuit Diagrams
- Drone/Robot Design Schematics
- Dashboard Screenshots
- Data Visualization Charts

4.5 References for Figures/Tables

- Sources reproduced from books, journals, websites, or research papers shall be properly cited.

Example:

(Source: After McGregor [12])

5. CODE, DATASET, AND EXPERIMENTAL RESULTS FORMAT

5.1 Source Code

- Important source code snippets may be included in the report.
- Large code files shall be included in appendices or digital media.

5.2 AI/ML/DL Project Requirements

Projects involving AI/ML/DL shall include:

- Dataset Description
- Training Parameters
- Model Architecture
- Performance Metrics
- Confusion Matrix/Graphs
- Experimental Results

5.3 IoT/Robotics/Embedded Project Requirements

Such projects shall include:

- Hardware Specifications
- Sensor Details
- Circuit Diagrams
- Communication Protocols
- Prototype Images
- Testing Results

6. BINDING AND COVER FORMAT

6.1 Binding

- The dissertation shall be hard-bound using rexine or equivalent material.

6.2 Front Cover

The front cover shall contain:

- Title of the Dissertation
- Name(s) of Student(s)
- Register Number(s)
- College Emblem/Logo
- Department Name
- Institution Name
- Degree and Semester
- Academic Year

6.3 Lettering

- Lettering on the cover and spine shall preferably be embossed in Gold/White/Silver color.

6.4 Spine Content

The following shall appear on the bound side:

- Student Name
- Degree Name
- Year of Submission

7. PRELIMINARY PAGES

7.1 Blank Pages

- One blank page may be inserted at the beginning and end of the dissertation for binding purposes.

7.2 Title Page

The title page shall include:

- Title of the Project
- Statement of Submission
- Degree Name
- Student Name and Register Number

- Name(s) of Guide/Supervisor
- Department and Institution Name
- Academic Year

7.3 Certificates and Declarations

The dissertation shall include:

- Institution Certificate
- Industry Certificate (if applicable)
- Student Declaration
- Plagiarism Declaration (optional/recommended)

8. REFERENCES AND CITATIONS

- References shall follow only IEEE citation style.
- All datasets, APIs, research papers, software libraries, frameworks, and online resources used in the project shall be properly acknowledged.
- AI-generated tools or services used during development/documentation, if any, shall be appropriately disclosed.

Questions Paper Pattern for Core Subjects

Duration:3 Hours

Max.Marks:80

Note: Answer any ten Questions from Part-A. And one full Question from each unit in Part-B

Part-A

1.

10*2=20

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.
- k.
- l.

Part-B

Each unit contains two main questions, and each carry 15 Marks. Each main question contains two or more sub question. Answer any ONE full main question from each Unit.

4*15=60

UNIT-I

2.

- a.
- b.
- c.

3.

- a.
- b.
- c.

UNIT-II

4.

- a.
- b.
- c.
- 5.
- a.
- b.
- c.
- 6.
- a.
- b.
- c.
- 7.
- a.
- b.
- c.
- 8.
- a.
- b.
- c.
- 9.
- a.
- b.
- c.

UNIT-III

UNIT-IV
