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	8[(2x3T)+2P]	8[(2x3T)+2P]	8[(2x3T)+2P]				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 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'Reily Publications
3. Robin Nixon, Learning PHP, My SQL, JavaScript, CSS and HTML5, 3rd Edition, O'Reily 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 Grolemund “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.

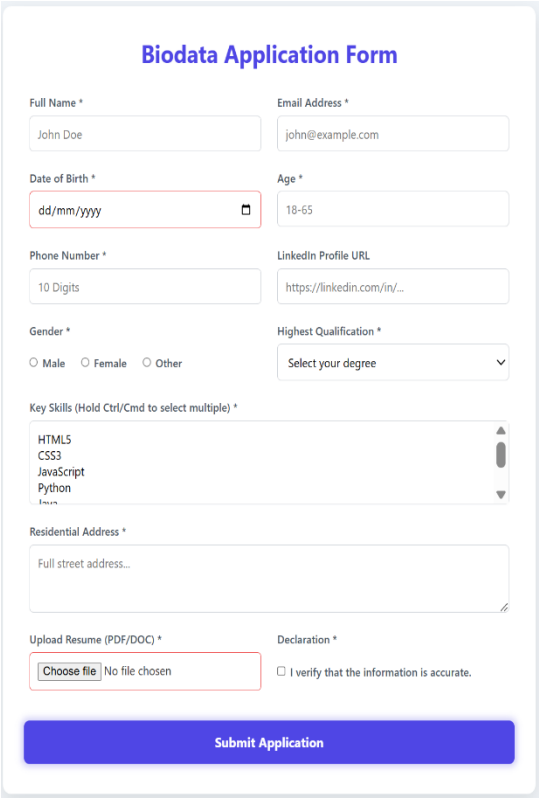
Program Name	**BCA-AIML**	Semester	**V**

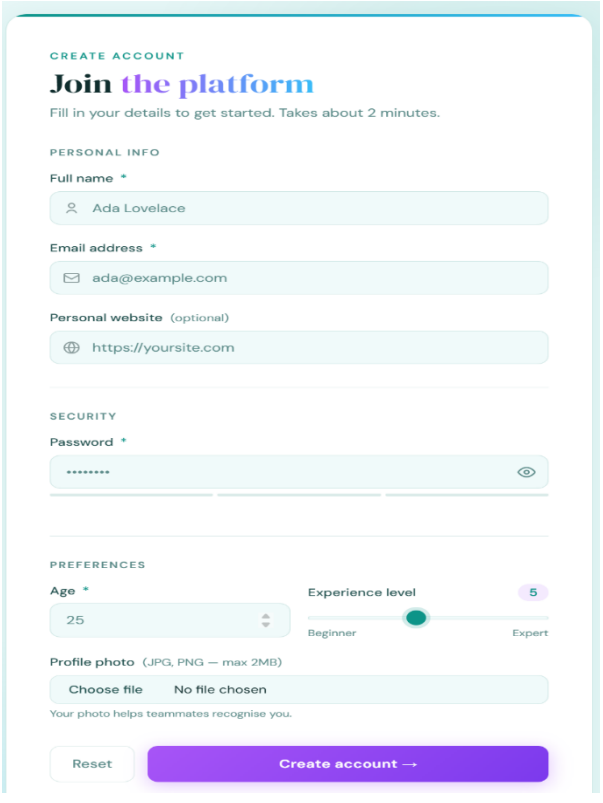
Course Title	**Web Application Development Lab**		
Course Code:	**BCAAIPS507**	No. of Credits	**02**
Contact hours	**52 Hours**	Duration of SEA/Exam	**3 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks	**40**

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.



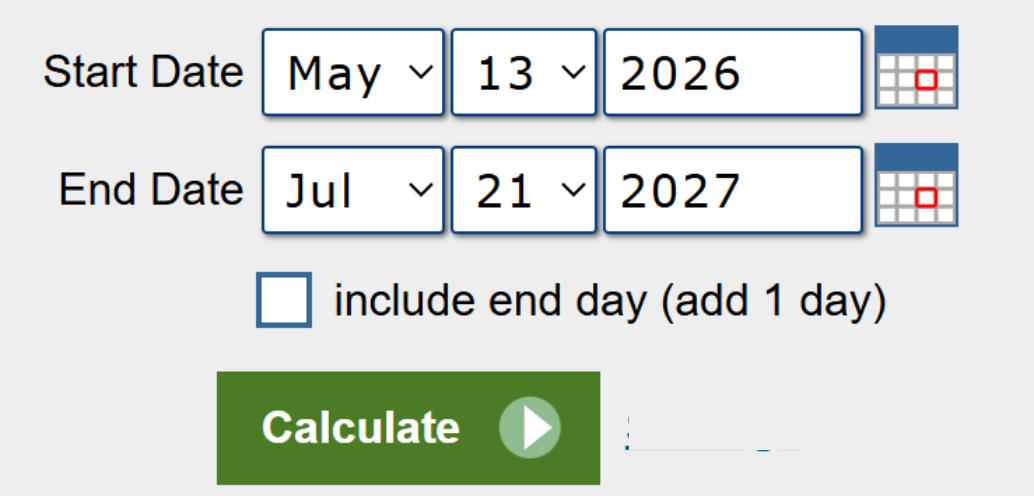


2. Design and implement a web page using HTML and CSS to create a box that performs multiple animations simultaneously.

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'.

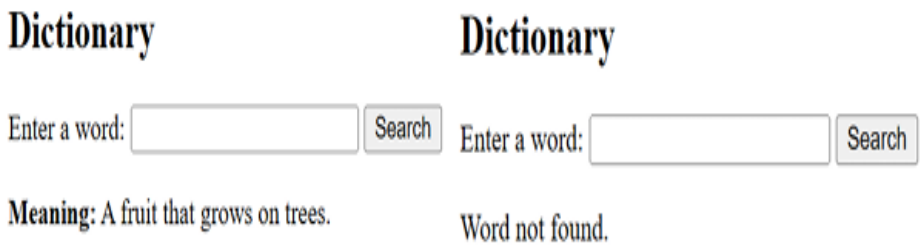


4. Write a PHP program with a user interface for calculating the number of days between two given dates. Display the difference in years, months, and days.



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)



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').

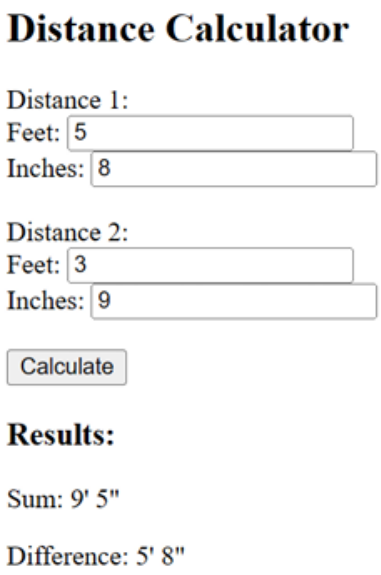


PART – B

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.



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

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

   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
   a) If n=4 and p=0.10, find P(x=3)
   b) If n=12 and p=0.45, find P(5<=x<=7)

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

6. Perform the following using uniform distribution between 200 and 240.
   a) P(x>230)
   b) P(205≤x≤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 α=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 RasberryPi OR using Simulation softwares like Tinkercad)

PART-A

1. Assume a regression algorithm generates a model $y = 0.54 + 0.66\,x$ 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 $x_1, x_2, x_3, \ldots x_{100}$. Perform the following on the data set generated.

a. Label the first 50 points {x_1, x_2, ,....x_{50}} as follows: if x_i<=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},.... 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 64x64=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 7th 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