# AI TOOLS AND APPLICATIONS LAB
## (Non CSE & IT)

**Course Code:22CS11D1**

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**Course Outcomes:** At the end of the course, a student will be able to:
CO1: Implement various basic linear algebra functions. (L3)
CO2: Make use of numpy and pandas libraries. (L3)
CO3: Solve real world problems using agents. (L3)
CO4: Apply classification and regression algorithms on real world data. (L3)
CO5: Develop models using supervised learning techniques (L3)

**LIST OF PROGRAMS:**

All the programs should be implemented in Python:

1. Write a Program to perform the following operations on matrices
   a) Matrix addition
   b) Matrix Subtraction
   c) Matrix Multiplication
   d) Matrix Inversion
   e) Transpose of a Matrix

2. Write a Program to perform the following operations
   a) Find the minimum and maximum element of the matrix
   b) Find the minimum and maximum element of each row in the matrix
   c) Find the minimum and maximum element of each column in the matrix
   d) Find trace of the given matrix
   e) Find rank of the given matrix
   f) Find eigenvalues and eigenvectors of the given matrix

3. Write a program for the following
   a. To generate an array of random numbers from a normal distribution for the array of a given shape.
   b. Implement Arithmetic operations on two arrays (perform broadcasting also.)
   c. Find minimum, maximum, mean in a given array. ( in both the axes )
   d. Implement np.arange and np.linspace functions.
   e. Create a pandas series from a given list.
   f. Create pandas series with data and index and display the index values.
   g. Create a data frame with columns at least 5 observations
      i. Select a particular column from the DataFrame
      ii. Summarize the data frame and observe the stats of the DataFrame created
      iii. Observe the mean and standard deviation of the data frame and print the values.

4. Write a python program to implement a Water Jug Problem?

5. Implement the Constraint Specific Problem (Ex: Cryptoarithmetic problem).

6. Write a python program to implement the n-queens problem.

7. Write a Program to determine the following in the Titanic Survival data.
   a. Determine the data type of each column.
   b. Find the number of non-null values in each column.
   c. Find out the unique values in each categorical column and frequency of each unique value.
   d. Find the number of rows where age is greater than the mean age of data.
   e. Delete all the rows with missing values.

8. Perform Data Analysis on the Titanic Data Set to answer the following.
   a. Information regarding each column of the data
   b. Impact of each column on the label
   c. Number of survivals in each gender
   d. Number of survivals in each passenger class
   e. The number of people who are not alone.

9. Perform Data Analysis on the California House Price data to answer the following
   a. Data Type of each column and info regarding each column
   b. The average age of a house in the data set.
   c. Determines top 10 localities with the high difference between income and house value. Also, top 10 localities that have the lowest difference
   d. What is the ratio of bedrooms to total rooms in the data
   e. Determine the average price of a house for each type of ocean_proximity.

10. Write a program to perform the following tasks
   a. Determine the outliers in each non-categorical column of Titanic Data and remove them.
   b. Determine missing values in each column of Titanic data. If missing values account for 30% of data, then remove the column.
   c. If missing values are less than 30% of entire data then create a new data frame
      i. Missing values in numeric columns are filled with the mean of the corresponding column.
      ii. Missing values in categorical columns are filled with the most frequently occurring value.

11. Write a program to perform the following tasks
   a. Determine the categorical columns in Titanic Dataset. Convert Columns with string data type to numerical data using encoding techniques.
   b. Convert data in each numerical column so that it lies in the range [0,1]

12. Implement the following models on Titanic Dataset and determine the values of accuracy, precision, recall, f1 score and confusion matrix for the test data.
   a. Logistic Regression
   b. Random Forest Classifier

13. Implement the following models on the California House Pricing Dataset and determine the values of $R^2$ score, the area under roc curve and root mean squared error for the test set.
   a. Linear Regression with Polynomial Features
   b. Random Forest Regressor

14. Write a program to implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.

15. Implement a single neural network and test for different logic gates.

16. Write a program to train and test a Convolutional Neural Network to determine the number, given an image of a handwritten digit. Determine the training and validation accuracies of your model. (Train your model for 5 epochs).

**SUGGESTED DATASETS:**

1. https://www.kaggle.com/c/titanic/data
2. https://www.kaggle.com/camnugent/california-housing-prices
3. https://www.kaggle.com/c/house-prices-advanced-regression-techniques

**REFERENCES:**

1. Dr.Nilakshi Jain, *Artificial Intelligence, As per AICTE: Making a System Intelligent*, Wiley Publications, 1st Edition,2019.
2. Vijayvargia, Abhishek, *Machine Learning with Python: An Approach to Applied Machine Learning*, BPB Publications; 1st edition,2018.
3. Dr.S.Lovelyn Rose, Dr. L.Ashok Kumar, Dr.D.Karthika Renuka, *Deep Learning using Python*, Wiley India Pvt. Ltd 2019.
4. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Pearson Publications, 4th Edition, 2020.
5. Saroj Kaushik, *Artificial Intelligence*, Cengage Learning India, 2011.

**WEB REFERENCES:**

1. https://keras.io/
2. https://ai.google/
3. https://www.coursera.org/learn/neural-networks-deep-learning#syllabus

https://swayam.gov.in/nd1_noc19_me71/preview