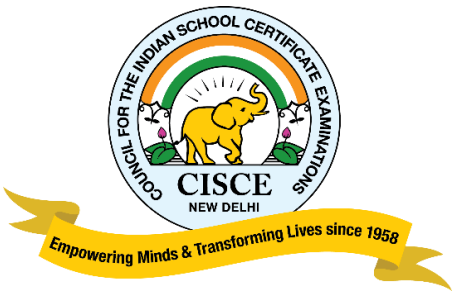
ISC

YEAR 2027

INDIAN SCHOOL CERTIFICATE EXAMINATION



ARTIFICIAL INTELLIGENCE (883)

February 2025

Council for the Indian School Certificate Examinations (CISCE)

MISSION STATEMENT

The Council for the Indian School Certificate Examinations is committed to serving the nation's children, through high quality educational endeavours, empowering them to contribute towards a humane, just and pluralistic society, promoting introspective living, by creating exciting learning opportunities, with a commitment to excellence.

ETHOS OF CISCE

- Trust and fair play.
- Minimum monitoring.
- Allowing schools to evolve their own niche.
- Catering to the needs of the children.
- Giving freedom to experiment with new ideas and practices.
- Diversity and plurality - the basic strength for evolution of ideas.
- Schools to motivate pupils towards the cultivation of:
  Excellence - The Indian and Global experience.
  Values - Spiritual and cultural - to be the bedrock of the educational experience.
- Schools to have an 'Indian Ethos', strong roots in the national psyche and be sensitive to national aspirations.

ARTIFICIAL INTELLIGENCE (883)

This subject may be taken with Computer Science but not with Robotics.

Aims

1. To develop an understanding of concepts and applications in AI.
2. To develop competencies in AI via classroom instruction, laboratory and self-directed project-based learning approach.
3. To facilitate appreciation, understanding and application of concepts of data science in AI through learning and engaging in hands-on activities.
4. To introduce concepts of data modelling.
5. To facilitate appreciation, understanding and application of concepts of neural networks and natural language processing.
6. To introduce concepts of generating predictions from data.

CLASS XI

There will be two papers in the subject:

***Paper I**: Theory - 3 hours ... 70 marks*

***Paper II**: Practical Exam - 3 hours ... 15 marks*
Project Work ... 10 marks
Practical File ... 5 marks

PAPER I- THEORY: 70 Marks

S. NO.	UNIT	TOTAL WEIGHTAGE
1.	Basic concepts of Artificial Intelligence	08 Marks
2.	Introduction and State of Art of AI, Natural Language Processing (NLP), and Potential use of AI	08 Marks
3.	Mathematics for AI	12 Marks
4.	Data Visualization	16 Marks
5.	Theoretical and Practical Aspects of Data Processing	08 Marks
6.	Data Modelling, Simple Linear Regression	12 Marks
7.	Ethical Practices in AI	06 Marks
TOTAL		70 Marks

PAPER I – THEORY – 70 Marks

1. Basic concepts of Artificial Intelligence

(i) Artificial Intelligence

Definition, Evolution, Applications in different fields, commonly used AI applications, benefits – decision making, remote patient monitoring, analysis of data, solving complex problems, etc.

(ii) Role of data and information, evolution computing

Types of data, identification, acquiring and exploring the data, binary logic system, conditional gates, deterministic and probabilistic nature of real- life problems with appropriate examples.

(iii) Overview of Decision making

Decision making in machines/computers; Cyber security in computing and machine intelligence.

(iv) Components of AI project framework

Problem scoping, data acquisition, data exploration, modeling and evaluation (in brief)

(v) Overview of Data representation and programming in Python

Datatypes, variables, operators, conditional statements, control statements, functions.

2. Introduction and State of Art of AI, Natural Language Processing (NLP), and Potential use of AI

(i) Brief History and Primary elements of AI

Definition of Machine Learning (ML) and Deep Learning (DL)/Neural Networks. Application of ML and DL: Image recognition/processing and Computer vision, Speech recognition, Information Retrieval (IR) through Search Engine, etc.

(ii) Domain of Natural Language Processing (NLP)

Text understanding, Text generation, Language translation (e.g., Google translate), Question answering (Chatbots), Dialogue systems (e.g., Siri and Alexa),Internet searches such as navigation searches (related to familiar brands and platforms, e.g., LinkedIn, YouTube), informational searches (for learning and understanding), transactional searches (for purchasing, signing up for services, or downloading apps), investigative searches (e.g., top-rated web series, movies), and voice searches.

(iii) Potential use of AI

Use of AI in various domains in Word Processing System like Smart Phones, Web-based Auction sites, Scanner machines, e-commerce platforms and social networking sites (brief explanation).

(iv) AI and Society

Social benefits of AI: Healthcare (enhancement in diagnosis treatment plans and patient care), Transportation (Autonomous vehicles and transport management system), Disaster Prediction (Early warning system and response management) and Agriculture (Precision farming, crop monitoring and yield prediction).

3. Mathematics for AI

(i) Matrices

Introduction to Matrices, Types of Matrices, Matrix Operations (Addition, subtraction, multiplication, transpose).

(ii) Vectors and its applications

Vector arithmetic

(iii) Set Theory

Introduction to data table joins, Context setting, Set Theory and Relational Algebra, Set operations.

(iv) Simple Statistical Concepts

Measures of Central Tendency (Mean, Median, Mode), Variance and Standard Deviation.

4. Data Visualization

(i) Data Visualization using Python Programming.

Using matplotlib and seaborn in Python, and Excel charts; Handling missing values, outliers, and inconsistencies in data using Python's pandas library and Excel's data cleaning features.

(ii) Data Visualization using Statistical Graphs

Types of Graphs-Bar Graph, Histogram, Scatter plot, Pie graph

(iii) Introduction to Dimensionality of Data.

Multi-dimensional data representation and visualization using graphs.

5. Theoretical and Practical Aspects of Data Processing

(i) Introduction to Data Cleaning.

Data cleaning techniques with Pandas; Handling duplicates and Inconsistent data.

(ii) Exploring Kaggle Datasets.

Creating and manipulating Data Frames from Kaggle Datasets.

(iii) Data Transformation and Standardization.

Methods for transforming and standardizing data for analysis.

6. Data Modeling, Simple Linear Regression

(i) Introduction to Data Modeling.

A brief understanding of Types of Data Models (Dimensional, relational and entity-relational).

(ii) Regression analysis.

Working of Regression (Dependent and Independent Variables), Types of Regression (in brief).

(iii) Linear Regression Equation.

Least Square Regression Line, Properties of Linear Regression, Regression coefficient, Types of Linear Regression (in brief).

(iv) Solving Linear Equations.

Applications of Linear Equations in various contexts.

7. Ethical Practices in AI

AI code of ethics- avoiding bias, ensuring privacy of users and their data, and mitigating environmental , importance of AI ethics –the effects of designing technology to replicate human life.

PAPER II – PRACTICALS-30 Marks

The practical paper of three hours duration will be evaluated internally by the school. The paper shall consist of three problem statements from which a candidate has to attempt any one problem statement.

The practical consists of two parts:

(1) Planning/Writing Session
(2) Examination Session

The total time to be spent on the Planning/Writing Session and the Examination session is three hours. A maximum of 90 minutes is permitted for the Planning/Writing Session and 90 minutes for the Examination session. **Candidates are to be permitted to proceed to the Examination Session only after the 90 minutes of the Planning / Writing Session are over.**

Planning/Writing Session

The candidates will be required to prepare an algorithm and a handwritten program to solve the problem.

Examination Session

The program handed in at the end of the Planning/Writing session shall be returned to the candidates. The candidates will be required to do and execute the program individually on the computer, hardware and show execution to the examiner. A printout of the program listing, including output should be attached to the answer script containing the handwritten program and hardware results. This should be returned to the examiner. The program should be sufficiently documented so that the material required, circuit diagram/block diagram, algorithm, representation and development process is clear from reading the program. Large differences between the planned program and the printout will result in loss of marks.

Teachers should maintain a record of all the assignments done as part of the practical work throughout the year and give it due credit at the time of cumulative evaluation at the end of the year. Students are expected to do a **minimum** of twenty assignments for the year and **ONE** project based on the syllabus.

LIST OF SUGGESTEDASSIGNMENTS:

1. How would you use Matplotlib to create a line plot for visualizing the trend of a dataset over time? Write a Python program demonstrating this.
2. Using Seaborn, how can you create a scatter plot to analyze the relationship between two variables in a dataset? Provide a Python program illustrating this.
3. Explain how to utilize Matplotlib to generate a bar plot for comparing the distribution of categories in a dataset. Write a Python program for this purpose
4. Write a Python program demonstrating how to identify outliers in a dataset and handle them using outlier detection techniques.
5. Describe how to create a box plot using Seaborn to visualize the distribution of a numerical variable. Provide a Python program to illustrate this.
6. How can you create a pair plot using Seaborn to visualize pairwise relationships between variables in a dataset? Write a Python program demonstrating this.
7. Write a Python program using NumPy to simulate coin flips and calculate the probability of getting heads.
8. Demonstrate how to generate random samples from a normal distribution using NumPy and visualize the distribution using Matplotlib. Provide a Python program for this task.
9. Write a Python program to create a Pandas DataFrame from a Kaggle dataset.
10. Perform a hypothesis test to determine if there is a significant difference in temperature between two cities. Write a Python script to conduct the test and interpret the results.

NOTE: This list is indicative only. Teachers and students should use their imagination to create innovative and original assignments.

EVALUATION OF PROGRAMMING ASSIGNMENTS

Marks (out of 30) should be distributed as given below.

Continuous Evaluation

Candidates will be required to submit a work file containing the practical work related to assignments done during the year and **ONE** project.

Programming assignments done throughout the year	10 marks
Project Work (based on any topic from the syllabus)	5 marks

Proposed Guidelines for Marking

The actual grading will be done by the teacher based on his/her judgment. One possible way: divide the outcome for each criterion into one of 3 groups: excellent, good, poor/unacceptable, then use numeric values for each grade and add to get the total.

Evaluation will be done as follows:

Programming Assignments:10 Marks

Criteria (Total10 marks)	Class design - Execution (4 marks)	Documentation Practical File (6 marks)
Excellent	4	6
Good	3	4
Poor	1	2

Project Work: **5 marks**

Criteria (Total 5 marks)	Knowledge and Understanding (1 marks)	Functionality and Performance (3 marks)	Presentation (1 marks)
Excellent	1	3	1
Good	1	2	1
Poor	1	1	1

Terminal Evaluation

Solution to Problem Statement on Hands-On/ Programming	15 marks

Marks should be given for choice of algorithm and implementation strategy, documentation, correct output on known inputs mentioned in the question paper, correct output for unknown inputs available only to the examiner.

CLASS XII

There will be two papers in the subject:

***Paper I**: Theory - 3 hours ... 70 marks*

***Paper II**: Practical - 3 hours ... 15 marks*

Practical File ... 15 marks

PAPER I- THEORY: 70 Marks

S. NO.	UNIT	TOTAL WEIGHTAGE
1.	Applications of AI	10 Marks
2.	Different paradigms of AI: Neural networks, Machine learning, Deep learning.	15 Marks
3.	Practical Implications of ANN	15 Marks
4.	Practical Implications of Machine Learning (ML)	20 Marks
5.	Introduction to Computer Vision (CV)	10 Marks
TOTAL		70 Marks

PAPER I – THEORY – 70 Marks

Note: Key concepts of Class XI need to be revised as a prerequisite.

1. Applications of AI

(i) Natural Language Processing (NLP): Named Entity Recognition (NER)

Identify and classify names of people, organizations, and locations in a news article, Text Summarization using Extraction Methods: Summarize a long passage by extracting the most important sentences or phrases, Spam Email Detection using Machine Learning: Build a model to classify emails as spam or non-spam based on their content and features.

(ii) Statistics and Probability

Understanding data trends using mean, median, mode, range, variance, and standard deviation; Probability Basics: Introducing probability as a measure of uncertainty, along with common distributions like uniform, normal, and binomial.

(iii) Hypothesis Testing

Understanding null and alternative hypotheses, Type I and Type II errors, and their relevance in AI experiments, Regression Analysis: Introducing simple linear regression for prediction and correlation coefficient for measuring relationships between variables.

2. Different paradigms of AI: Neural Networks, Machine Learning, Deep Learning

(i) Artificial Neural Networks (ANN)

About Artificial Neural Networks, nodes (neurons), Input layer, Hidden layer, Output layer, Forward and Backward propagation in ANN, ANN model, Multi-layer perceptron (MLP), Example- Recognizing handwritten digits using a multi-layer perceptron (MLP).

(ii) Machine Learning (ML)

Brief understanding of Machine Learning; An AI paradigm enabling computers to learn from data and make predictions or decisions without explicit programming. Example- Predicting house prices based on features like size, location, and number of bedrooms using a decision tree.

(iii) Deep Learning (DL):

About Deep Learning, Neural Network utilized for image recognition, pattern recognition, and/or computer vision. Example- Classifying images into different categories (e.g., cat, dog, bird) using a Convolution Neural Network (CNN).

3. Practical Implications of ANN

(i) Data Preparation

Use NumPy for numerical computations and Pandas for data manipulation.

Employ Scikit-learn for data preprocessing tasks like scaling, encoding categorical variables, and splitting data into training and testing sets.

(ii) Building the Neural Network

Choose Keras or TensorFlow: Keras is easy to use and runs on top of TensorFlow, making it beginner friendly.

(iii) Training the Neural Network

Fit your data to the neural network model using the fit() function, specifying the number of epochs and batch size.

(iv) Model Evaluation

Evaluate the model's performance on the test data using metrics like accuracy, precision, and recall.
Visualize performance metrics using libraries like Matplotlib to gain insights.

(v) Tuning

Utilize techniques like grid search or random search to tune hyper parameters such as learning rate, batch size, and number of hidden layers and neurons.

4. Practical Implications of Machine Learning (ML)

(i) Predictive Maintenance

Using historical data from machines to predict equipment failure or require

maintenance, helping to minimize downtime and optimize maintenance schedules.

(ii) Fraud Detection

Credit card fraud or identity theft, enabling financial institutions to take proactive measures to prevent losses.

(iii) Medical Diagnosis

Analysing Medical Imaging, Genetic Information, and Patient records for diagnosis.

5. Introduction to Computer Vision (CV)

(i) Introduction to CV, Application of Open CV in real world scenario

Image Classification, Object Detection, Facial Recognition, Color Detection, Object Tracking (brief explanation with examples).

(ii) Image Classification

Implementing a simple image classifier to distinguish between different categories of objects, such as cats vs. dogs or fruits vs. vegetables.

(iii) Object Detection

Identification and localization of specific objects within an image, such as detecting cars in a street scene or detecting faces in a photograph.

(iv) Facial Recognition

Building a facial recognition application that can recognize and identify faces in images or videos, and optionally, associate them with known individuals.

(v) Color Detection

Identification and classification of objects based on their color properties, such as sorting colored objects on a conveyor belt or detecting ripe fruits in agriculture.

(vi) Object Tracking

Track the movement of objects in a video sequence over time, such as tracking the trajectory of a ball in sports footage or monitoring vehicles in traffic surveillance.

PAPER II – PRACTICALS - 30 Marks

The practical paper of three hours' duration will be evaluated by the Visiting Examiner appointed locally and approved by CISCE.

The paper shall consist of three problem statements /problems from which a candidate has to attempt any one. The practical consists of two parts:

(1) Planning/ Writing Session
(2) Examination Session

The total time to be spent on the Planning/Writing Session and the Examination session is three hours. A maximum of 90 minutes is permitted for the Planning/Writing Session and 90 minutes for the Examination session.

Candidates are to be permitted to proceed to the Examination Session only after the 90 minutes of the Planning / Writing Session are over.

Planning/Writing Session

The candidates will be required to prepare an algorithm and a handwritten program to solve the problem.

Examination Session

The program handed in at the end of the Planning/Writing session shall be returned to the candidates. The candidates will be required to code and execute the program individually on the computer, hardware and show execution to the Visiting Examiner. A printout of the program listing including output results should be attached to the answer script containing the handwritten program and hardware results. This should be returned to the examiner. The program should be sufficiently documented so that the material required, circuit diagram/block diagram, algorithm, representation and development process is clear from reading the program. Large differences between the planned program and the printout will result in loss of marks.

Teachers should maintain a record of all the assignments done as part of the practical work throughout the year and give it due credit at the time of cumulative evaluation at the end of the year. Students are expected to do a **minimum of twenty-five assignments** for the year.

The details are as follows:

Details of Assignments to be done during the year

Broad Area	Number of Assignments
Practical (Programming)	15
Hands-on (Case Study)	10
TOTAL	**25**

LIST OF SUGGESTED ASSIGNMENTS:

Some sample problems are given below as examples. The problems are of varying levels of difficulty:

1. Tokenization and Text Preprocessing: Demonstrate tokenization techniques using NLTK or spaCy in Python to break down sentences into individual words or tokens.
2. Named Entity Recognition (NER): Implement NER using spaCy to identify and classify named entities such as persons, organizations, and locations in text data.
3. Probability Distributions: Explore different probability distributions (e.g., normal, binomial, Poisson) using Python libraries like NumPy and visualize their properties using Matplotlib.
4. Hypothesis Testing: Perform hypothesis testing (e.g., t-test, chi-square test) on sample data to make inferences about population parameters.
5. Create a Python script to train a linear regression model using the NumPy library to predict a car's fuel efficiency (in miles per gallon) based on its engine size (in liters).
6. Write a Python script to train a linear regression model using the NumPy library to predict a student's final exam score based on their study hours.
7. Implementing Forward and Backward Propagation: Build a simple neural network from scratch in Python to understand the concepts of forward and backward propagation.
8. Introduction to Hidden Layers: Extend the basic neural network by adding hidden layers and activation functions to demonstrate the role of hidden layers in learning complex patterns.
9. Generate attendance monitoring system to track the attendance of the students using Open-CV.
10. Introduction to CPU, GPU, TPU and DPU and their distinction for individual projects/research in AI.

NOTE: This list is indicative only. Teachers and students should use their imagination to create innovative and original assignments.

EVALUATION OF PROGRAMMING ASSIGNMENTS

Marks (out of 30) should be distributed as given below.

Continuous Evaluation

Candidates will be required to submit a work file containing the practical work related to assignments done during the year.

Programming assignments done throughout the year (Internal Evaluation)	10 marks
Programming assignments done throughout the year (Visiting Examiner)	5 marks

Proposed Guidelines for Marking

The actual grading will be done by the teacher based on his/her judgment. One possible way: divide the outcome for each criterion into one of 3 groups: excellent, good, poor/unacceptable, then use numeric values for each grade and add to get the total.

Evaluation will be done as follows:

Programming Assignments: 10 Marks

Criteria (Total 10 marks)	Class design - Execution (4 marks)	Documentation Practical File (6 marks)
Excellent	4	6
Good	3	4
Poor	1	2

Terminal Evaluation

Solution to Problem Statement on Hands-On/ Programming	15 marks

Marks should be given for choice of algorithm and implementation strategy, documentation, correct output on known inputs mentioned in the question paper, correct output for unknown inputs available only to the examiner.

Note: Algorithm should be expressed clearly using any standard scheme such as a pseudo code.

LABORATORY REQUIREMENTS

(For a class of 30 students)

I. Hardware Requirements:

Group of 2 Students: 1 Desktop along with Webcam

1. Webcam Detailed Description:

   Video Capture Resolution 1080p
   Maximum Focal Length 1080
   Maximum Aperture 2 f
   Reference: Logitech Brio 100 Full HD Webcam

2. Desktop Configuration

   Detailed Description:
   Dell Optiplex 3000 Desktop:
   12th Generation Intel Core I5-12500
   Processor Intel B660 Chipset
   2GB NVidai Dedicated Graphics
   ENERGY STAR Qualified
   8GB, DDR4, Non-ECC Ram 3200 Mhz
   M.2 512GB Gen 4 PCIe NVMe Solid State Drive
   Power Cord 1M for India Dell USB Keyboard & Optical Mouse
   Windows 11 Pro OEM with License
   Dell 24" Display
   Wifi Card + HDMI 1 Mtr. Cable

3 Years onsite Warranty

Micro-Tech UPS - 600 VA (15 mins)

II. Software Requirements:

Operating System: Windows 10 or Linux (Ubuntu recommended for AI applications) for flexibility in using open-source libraries.
Programming Tools:

- Python (latest version): Primary programming language for AI applications.
- IDEs:
  - Jupyter Notebook or Google Colab (for cloud-based Python coding).
  - PyCharm or VS Code for offline programming.
- AI Libraries:
  - NumPy, Pandas, and Matplotlib: For data manipulation and visualization.
  - Scikit-learn: For machine learning algorithms.
  - TensorFlow or PyTorch: For deep learning and neural networks.
  - OpenCV: For computer vision projects.
  - NLTK or spaCy: For natural language processing (NLP) projects.
- Database Tools: MySQL or SQLite for storing and managing datasets.
- Cloud Platforms:
  - Google Colab or Amazon Web Services (AWS) for running large AI models.
  - GitHub for version control and collaborative projects.

III. AI Kits (Optional but Beneficial):

- Raspberry Pi AI Kits: For experimenting with AI on hardware devices.
- Robotics kits: For AI integration into robotics projects.

SAMPLE TABLE FOR PRACTICAL WORK

S. No.	Unique Identification Number (Unique ID) of the candidate	Assessment of Practical File		Assessment of the Practical Examination (To be evaluated by the Visiting Examiner only)				TOTAL MARKS (Total Marks are to be added and entered by the Visiting Examiner)
		Internal Evaluation 10 Marks	Visiting Examiner 5 Marks	Algorithm	Python Program with internal Documentation	Hard Copy (printout)	Output	
				3 Marks	7 Marks	2 Marks	3 Marks	30 Marks
1.								
2.								
3.								
4.								
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6.								
7.								
8.								
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10.								

Name of the Visiting Examiner:_____

Signature: _____

Date:_____