CBSE | DEPARTMENT OF SKILL EDUCATION

CURRICULUM FOR SESSION 2021-2022

ARTIFICIAL INTELLIGENCE (SUB. CODE 843)

CLASS – XI & XII

COURSE OVERVIEW:

AI is a discipline in computer science that focuses on developing intelligent machines, machines that can learn and then teach themselves. These machines, then, can process vast amounts of data than humans can, and several times faster. However, AI can go across all disciplines to change the world for the better– from creating new healthcare solutions, to designing hospitals of the future, improving farming and our food supply, helping refugees acclimate to new environments, improving educational resources and access, and even cleaning our oceans, air, and water supply. The potential for humans to improve the world through AI is endless, as long as we know how to use it.

OBJECTIVES OF THE COURSE:

In this course, the students will develop knowledge, skills and values to understand AI and its implications for our society and the world and to use AI to solve authentic problems, now and in the future. The students will engage with a host of multi-media online resources, as well as hands-on activities and sequence of learning experiences.

The following are the main objections of the course:

1. Develop informed citizens with an understanding of AI and the skills to think critically and knowledgeably about the implications of AI for society and the world
2. Develop engaged citizens with a rigorous understanding of how AI can be harnessed to improve life and the world we live in
3. Stimulate interest and prepare students for further study to take up careers as AI scientists and developers to solve complex real world problems

SCHEME OF UNITS

This course is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Class XI opting for skill subject along with other education subjects. The unit-wise distribution of hours and marks for class XI is as follows:

ARTIFICIAL INTELLIGENCE (SUBJECT CODE - 843)

Class XI (Session 2021-22)

Total Marks: 100 (Theory - 50 + Practical - 50)

	Term	UNITS	HOURS (Theory + Practical)	MAX. MARKS (Theory + Practical)
Part A		**Employability Skills**		
	Term I	Unit 1 : Communication Skills-III	10	10
		Unit 2 : Self-Management Skills-III	10	
		Unit 3 : ICT Skills-III	10	
	Term II	Unit 4 : Entrepreneurial Skills-III	15	
		Unit 5 : Green Skills-III	05	
		Total	**50**	**10**
Part B		**Subject Specific Skills**		
	Term I	**Unit 1:** Introduction To AI	30	20
		Unit 2: *AI Applications & Methodologies**	30	
		Unit 3: Maths For AI	10	
		Unit 4: AI Values (Ethical Decision Making)	5	
		Unit 5: *Introduction To Storytelling**	20	
	Term II	***Unit 6:*** *Critical & Creative Thinking**	5	20
		Unit 7: *Data Analysis (Computational Thinking)**	30	
		Unit 8: Regression	30	
		Unit 9: Classification & Clustering	20	
		Unit 10: *AI Values (Bias Awareness)**	30	
		***Unit 2, 5, 6, 7 & 10 are to be Assessed through Practicals Only**		
		Total	**210**	**40**
Part C		**Practical Work –** • *Unit 2: AI Applications & Methodologies* • *Unit 5: Introduction To Storytelling* • *Unit 6: Critical & Creative Thinking* • *Unit 7: Data Analysis (Computational Thinking)* • *Unit 10: AI Values (Bias Awareness)*		
		Practical Examination		40
		Viva-Voce		
		Total		**40**
Part D		**Project Work/ Field Visit/ Project/ Ideation + presentation**		10
		Viva-Voce		
		Total		**10**
		GRAND TOTAL	**260**	**100**

DETAILED CURRICULUM/ TOPICS FOR CLASS XI

PART-A: EMPLOYABILITY SKILLS

S. No.	Units	Duration in Hours
1.	Unit 1: Communication Skills-III	10
2.	Unit 2: Self-management Skills-III	10
3.	Unit 3: Information and Communication Technology Skills-III	10
4.	Unit 4: Entrepreneurial Skills-III	15
5.	Unit 5: Green Skills-III	05
	TOTAL	**50**

NOTE: **Detailed Curriculum/ Topics to be covered under Part A: Employability Skills can be downloaded from CBSE website**.

Part-B – SUBJECT SPECIFIC SKILLS

- **TERM I:**

Level I: AI Informed (AI Foundations)	• Unit1: Introduction to AI • *Unit 2: AI Applications & Methodologies** • Unit 3: Math for AI • Unit 4: AI Values (Ethical Decision Making) • *Unit 5: Introduction to Storytelling**

- **TERM II:**

Level 2: AI Inquired (AI Apply)	• *Unit 6: Critical & Creative Thinking** • *Unit 7: Data Analysis (Computational Thinking)** • Unit 8: Regression • Unit 9: Classification & Clustering • *Unit 10: AI Values (Bias Awareness)**

NOTE: * UNITS 2, 5, 6, 7 & 10 should be assessed in Practical Examination only and should not be assessed in Theory Examination.

DETAILED CURRICULUM/ TOPICS

LEVEL I: AI INFORMED (AI Foundations) -

UNIT	TOPICS	LEARNING OUTCOMES

Unit 1: Introduction
 	
(knowledge)
	Introduction-AI for everyone
	• What is AI?
	  ○ Kids can AI
	• History of AI
	• What is Machine Learning
	  ○ Difference between conventional programming and machine learning
	  ○ How is Machine learning related to AI?
	• What is data?
	  ○ Structured
	  ○ Unstructured
	  ○ Examples of unstructured data- text, images
	• Terminology and Related Concepts Intro to AI
	  ○ Machine learning
	  ○ Supervised learning (examples)
	  ○ Unsupervised learning (examples)
	  ○ Deep learning
	  ○ Reinforcement learning
	  ○ Machine Learning Techniques and Training
	  ○ Neural Networks
	• What machine learning can and cannot do
	• More examples of what machine learning can and cannot do
	• Jobs in AI
		Knowledge – Define AI and ML
		
		Comprehension – What are the AI products/ applications in society and how are they different from non-AI products/ applications?
		
		Evaluation – What kind of jobs may appear in the future?

Unit 2: AI Applications and Methodologies
 	
(Introduction)
 	
(Knowledge)
	Present day AI and Applications
	• Key Fields of Application in AI
	  ○ Chatbots (Natural Language Processing, speech)
	  ○ Alexa, Siri and others
	  ○ Computer vision
	  ○ Weather Predictions
	  ○ Price forecast for commodities
	  ○ Self-driving cars
	• Characteristics and types of AI
	  ○ Data driven
	  ○ Autonomous systems
	  ○ Recommender systems
	  ○ Human like
		Knowledge – Where can AI be applied (like in the field of Computer vision, Speech, Text, etc.), What is deep learning?
		
		Comprehension – How AI will impact our society
		
		Analysis – How should we get ready for the AI age (future)

UNIT	TOPICS	LEARNING OUTCOMES
	• Cognitive Computing (Perception, Learning, Reasoning) Cognitive computing • Recommended deep-dive in NLP, CV, etc.* • AI and Society coursera-ai-for-everyone • The Future with AI, and AI in Action (Introduction) • Non-technical explanation of deep learning coursera-ai-for-everyone	

Unit 3: Maths for AI
(Recap)
(Knowledge)
	• Introduction to matrices (Recap)
	• Introduction to set theory (Recap)
	  ○ Introduction to data table joins
	• Simple statistical concepts
	• Visual representation of data, bar graph, histogram, frequency bins, scatter plots, etc.
	• With co-ordinates and graphs introduction to dimensionality of data
	• Simple linear equation
	  ○ Least square method of regression
		Comprehension – Linear Algebra, Statistics, Basics of Graphs and Set theory
		
		Application – Application of Math in AI
		
		Synthesis – Representing data in term of mathematical formula

Unit 4: AI Values (Ethical decision making) (Values)	AI: Issues, Concerns and Ethical Considerations • Issues and Concerns around AI • AI and Ethical Concerns • AI and Bias • AI: Ethics, Bias, and Trust • Employment and AI	**Knowledge** – Ethics, Bias, Impacts of bias on society **Application** – Spot issue in data, Make arguments, Apply rules

Unit 5: Introduction to story telling
(Skills)
	• Storytelling: communication across the ages
	  ○ Learn why storytelling is so powerful and cross-cultural, and what this means for data storytelling
	• The Need for Storytelling
	• Story telling with data
	  ○ By the numbers: How to tell a great story with your data.
	• Conflict and Resolution
	  ○ Everyone wants to resolve conflict, and a good data storyteller is there to help!
	• Storytelling for audience
	  ○ Your data storytelling depends on the background knowledge of your audience.
	• Insights from storytelling
	  ○ Make the audience care about the data
	  ○ Keep the audience engaged
	  ○ Create from the end; present from the beginning
	  ○ Start with an anecdote, end with the data
	  ○ Build suspense, not surprise
		Skill – Imagination, mapping the plot into key events increasing memory retention.
		
		Application- Helping in creating blogs, videos, and other content.

LEVEL 2: AI INQUIRED (AI Apply)

UNIT	TOPICS	LEARNING OUTCOMES
Unit 6: Critical and Creative thinking (Skills)	• Design thinking framework ○ Right questioning (5W and 1H) ○ Identifying the problem to solve ○ Ideate	**Skill –** Understanding the problem and being able to express the same **Creativity –** To be able to develop/innovate from design a solution
Unit 7: Data Analysis (Computational thinking) **(Skills)**	• Types of structured data ○ Date and time ○ String ○ Categorical • Representation of data • Exploring Data Exploring data (Pattern recognition) ○ Cases, variables and levels of measurement ○ Data matrix and frequency table ○ Graphs and shapes of distributions ○ Mode, median and mean ○ Range, interquartile range and box plot* ○ Variance and standard deviation* ○ Z-scores* ○ Example ○ **Practice exercise**	**Knowledge** – Types of structured data, statistical principals – frequency tables, mean, median, mode, range, etc. **Application** – Representing data in terms of graphs, statistical models **Synthesis** – To be able to represent a simple problem in terms of numbers
Unit 8: Regression (Knowledge)	• Correlation and Regression ○ Crosstabs and scatterplots ○ Pearson's r ○ Regression - Finding the line ○ Regression - Describing the line ○ Regression - How good is the line? ○ Correlation is not causation ○ Example contingency table ○ Example Pearson's r and regression Readings ○ Correlation ○ Regression ○ Caveats and examples ○ **Practice exercise Correlation and Regression** ○ Explain the importance of data from above examples ○ How prediction changes with changing data?	**Knowledge** – Correlations, Regression, and other related terms **Applications** – Being able to relate data with regression and correlation. Everyday applications of these mathematical concepts.

Unit 9: Classification & Clustering (Knowledge)	• What is a classification problem? • Examples - Simple binary classification • Introduction to binary classification with logistic regression • True positives, true negatives, false positives and false negatives ○ Where we should care more with examples ○ Example- false negative of a disease detection can have different implication than false positive, one will be more physical harm and other will be mental • **Practice exercise on simple Binary Classification model**	**Knowledge** – What is classification and its types, what kind of problems may be placed under the category of a classification problem **Applications** – Where to apply classification principals **Analysis** – Impact of the application of incorrect algorithms on society
	• What is a clustering problem? • Why is it unsupervised? • Examples • **Practice exercise on simple Clustering model**	**Knowledge** – Clustering problems and its application, why is it called clustering **Application** – Application of clustering problem using standard models
Unit 10: AI Values (Bias awareness) (Values)	• AI working for good • Principles for ethical AI • Types of bias (personal /cultural /societal) • How bias influences AI based decisions • How data driven decisions can be de-biased • **Hands on exercise to Detect the Bias** (Intro to AI)	**Knowledge** – What is ethics, Impact of ethics on society, the impact of bias on AI functioning **Evaluation** – Biases in data, how to de-bias or neutralize the biased data **Application** – Finding bias in acquired dataset

NOTE: UNITS 2, 5, 6, 7 & 10 should be assessed through Practicals only and should not be assessed with the Theory Exam.

CBSE | DEPARTMENT OF SKILL EDUCATION

ARTIFICIAL INTELLIGENCE (SUBJECT CODE - 843)

Class XII (Session 2021-22)

Total Marks: 100 (Theory - 50 + Practical - 50)

	TERM	UNITS	NO. OF HOURS (Theory + Practical)	MAX. MARKS (Theory + Practical)
PART – A	**Employability Skills**			
	Term I	Unit 1: Communication Skills-IV	10	05
		Unit 2: Self-Management Skills-IV	10	
		Unit 3: ICT Skills-IV	10	
	Term II	Unit 4: Entrepreneurial Skills-IV	15	05
		Unit 5: Green Skills-IV	05	
		Total	**50**	**10**
PART – B	**Subject Specific Skills**			
	Term I	Unit 1: Capstone Project	10	20
		Unit 2: Model Lifecycle	10	
	Term II	Unit 3: Storytelling Through Data	15	20
		Total	**35**	**40**
PART – C	**Student Capstone Project (PRACTICAL)**			
		Student AI project Development & Presentation (Team work): Submissionof Project Logbook and Video presentation	30	50
		Total	**30**	**50**
		GRAND TOTAL	**115 Hours**	**100**

DETAILED CURRICULUM/ TOPICS FOR CLASS XII

PART-A: EMPLOYABILITY SKILLS

S. No.	Units	Duration in Hours
1.	Unit 1: Communication Skills-IV	10
2.	Unit 2: Self-management Skills-IV	10
3.	Unit 3: Information and Communication Technology Skills-IV	10
4.	Unit 4: Entrepreneurial Skills-IV	15
5.	Unit 5: Green Skills-IV	05
	TOTAL	**50**

NOTE: **Detailed Curriculum/ Topics to be covered under Part A: Employability Skills can be downloaded from CBSE website**.

Part-B – SUBJECT SPECIFIC SKILLS

- **TERM I:**

Level 3: AI Innovate	• Unit 1: Capstone Project • Unit 2: Model lifecycle (Knowledge)

- **TERM II:**

Level 3: AI Innovate	• Unit 3: Storytelling through data (Critical and Creative thinking Skills)

DETAILED CURRICULUM/ TOPICS

AI Innovate - (Level 3)		

Unit 1: Capstone Project	• Understanding the problem
	• Decomposing the problem through DT framework
	• Analytic Approach
	• Data Requirements
	• Data Collection
	• Modelling approach
	• How to validate model quality
	  ➢ By test-train split
	  ➢ Introduce concept of cross validation
	• Metrics of model quality by simple Maths and examples from small datasets – scaled up to capstone project (Apply)
	  ➢ RMSE- Root Mean Squared Error
	  ➢ MSE – Mean Squared Error
	  ➢ MAPE – Mean Absolute Percent Error
	• Introduction to commonly used algorithms and the science behind them
	• Showcase through a compelling story
		10 hours to complete basic levels.

Unit 2: Model lifecycle (Knowledge)	• Different aspects of Model
	  ➢ Train, test, validate,
	  ➢ What are hyper parameters
	  ➢ Commonly used platforms to build and run models (Introduction)
	  ➢ Recommended tools
	  ➢ Links to different platforms
	  o Watson
	• Lifecycle of an AI model
	  ➢ Build
	  ➢ Deploy
	  ➢ Retrain
		10 hours to complete basic levels.

AI Innovate - (Level 3)		

Unit 3: Story-telling through data (Critical and Creative thinking Skills)	• The Need for Storytelling
	  ○ Information processing and recalling stories
	  ○ Why is storytelling important?
	  ○ Structure that story!
	• How to create stories?
	  ○ Begin with a pen-paper approach
	  ○ Dig deeper to identify the sole purpose of your story
	  ○ Use powerful headings
	  ○ Design a Road-Map
	  ○ Conclude with brevity
	• Ethics of storytelling
	• Types of Data and Suitable Charts
	  ○ Text [Wordclouds]
	  ○ Mixed [Facet Grids]
	  ○ Numeric [Line Charts/ Bar Charts]
	  ○ Stocks [Candlestick Charts]
	  ○ Geographic [Maps]
	• Stories During the Steps of Predictive Modeling
	  ○ Data Exploration
	  ○ Feature Visualizing
	  ○ Model Creation
	  ○ Model Comparisons
	• Best Practices of Storytelling
	• Reference Material /Online Resources:
	  ○ Analytics Vidhya (https://www.analyticsvidhya.com/blog/2020/05/art-storytelling-analytics-data-science/)
	  ○ Udemy: (https://www.udemy.com/course/tell-a-story-with-data/)
	  ○ Coursera: (https://www.coursera.org/learn/intro-business-analytics)
	  ○ Coursera: (https://www.coursera.org/learn/communicate-with-impact)
		15 hours to complete basic levels.

Student Project Work (Practical)	Student capstone project development • Students to form teams and work on developing an AI based project • Resources like the AI Project Guide and AI Project LogBook to be used	30 hours

LIST OF EQUIPMENT/ MATERIALS:

The list given below is suggestive and an exhaustive list should be compiled by the teacher(s) teaching the subject. Only basic tools, equipment and accessories should be procured by the Institution so that the routine tasks can be performed by the students regularly for practice and acquiring adequate practical experience.

- Desktop Computer/ Laptop / Tablet
- Web cam (in case of desktop)
- Scanner
- Projector & Screen
- Printer
- Software: Microsoft Office Applications, Anaconda Navigator, Web Browser (preferably Google Chrome and/or Mozilla Firefox)
- Hub/switch
- Internet

CAREER OPPORTUNITIES:

- Data Scientist
- Data Architect
- ML Engineer
- Data Analyst
- Game Programmer
- Business Intelligence Developer
- Software Engineer – AI
- AI Research Scientist