Discipline Specific Electives (DSE): 04 Credits

DSE (IV.3.1) AI and Machine Learning Algorithms for Educational Data Mining
Discipline Specific Elective

1. Credit Distribution of the Course

Course title & Code DSE (IV.3.1)	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
AI and Machine Learning Algorithms for Educational Data Mining	4	2	0	2	Undergraduate	NIL

2. Learning Objectives

The course focuses on Education Data Mining (EDM) as an emerging field at the intersection of education and data science using Artificial Intelligence (AI) and Machine Learning (ML). Students will learn about large scale data in education available with open sources (public repositories), government reports and other sources. Students will learn the fundamentals of AI and ML algorithms that are applied to educational datasets extracting meaningful patterns and making data-driven decisions. from educational datasets. The course blends theoretical foundations with hands-on practical using real and synthetic educational datasets.

3. Learning Outcomes

- Understand the types and sources of educational data (institutional, virtual platform, learner-generated, research specific);
- Explore the core principles of AI, ML at the intersection of data mining in educational contexts;
- Apply basic and advanced ML algorithms (classification, clustering, regression) to educational data;
- Interpret learning analytics for early predictions, interventions and designing personalized learning environments.

4. Syllabus **[30 hours]**

Unit I Introduction to Educational Data Mining (EDM) - Understanding educational data and learning analytics; AI applications in early predications, adaptive learning, assessment, and educational policy; Sources of large scale educational data; Data privacy and ethical practices in educational research. **[6 hours]**

Unit II Data Mining Techniques in Educational Datasets - Data types, data structures, data cleaning, pre-processing and feature selection; Descriptive statistics and exploratory data analysis; Visualization of data using descriptive measures; Common educational datasets. **[8 hours]**

Unit III Understanding Machine Learning Algorithms for Educational Datasets - Introduction to different ML algorithms relevant for educational datasets (Classification algorithms (Decision tree), Regression analysis (Linear regression), Clustering algorithms (K-Means), Ensemble models (Random Forest, Gradient Boosting)); Model evaluation; Interpreting results for decision making. **[8 hours]**

Unit IV Deep Learning and Natural Language Processing - Basics of deep learning and neural network; Understanding text mining processes in educational contexts such as students' feedback/discussion forum; Interpreting sentiment analysis reports; Understanding process behind Chatbots and Intelligent/Adaptative Tutoring Systems; Bias and ethical issues in using AI algorithms in EDM. **[8 hours]**

5. Practicals **[60 hours]**

- Prepare codebooks for raw educational datasets and present it meaningfully for analysis and interpretation.
- Create a data dashboard depicting relationships between variables.
- Prepare a feature chart and catergorization table for raw and pre-processing data from educational data repositories.
- Make a comparative sheet for AI models for their efficiency on different kinds of datasets (two variables; multi-variables, linear and non-linear).
- Preparing a report and suggestive measures based on sentiment analysis.
- Prepare a protocol design for clustering students based on learning behaviour.
- Review 20 research papers to identify meta trends in EDM research.
- Make an advisory guideline framework for ethical and inclusive practices for EDM.
- Make a decision making map for developing ML pipelines for different datasets.

6. Essential Readings

- Romero, C. & Ventura, S. (2020). *Educational Data Mining: State of the Art.* IEEE.
- Baker, R. S. (2020). *Big Data and Education.* Routledge.
- Holmes, W. et al. (2019). *Artificial Intelligence in Education.* CCR.
- Luckin, R. (2020). *Machine Learning and Human Intelligence.* UCL Press.

7. Suggestive Readings

- Khan, B., Corbeil, J. R. & Corbeli, M. E. (2018). Responsible Analytics and Data Mining in Education: Global Perspectives on Quality, Support, and Decision Making, (ed.). Routledge.
- Sweta, S. (2021). Modern Approach to Educational Data Mining and Its Applications. Springer.