Course Type	Course Code	Name of Course	L	T	P	Credit
DC11	**MNC305**	**MINE AUTOMATION AND DATA ANALYTICS (new)**	3	0	0	9

Course Objective

This course will cover mine automation, as well as data analytics applicable to mining systems

Learning Outcomes

The students will gain a comprehensive overview of state of the art mining automation, as well as, practical skills in artificial intelligence and other digital technologies used in the mining industries

Sl. No.	Major Topics	No. of Lectures	Learning outcomes
1	Basic Elements of an Automated System, Automation in Production System, Principles and Strategies of Automation, Advanced Automation Functions, Levels of Automations, Introduction to automation productivity. Autonomous mining systems - Operations Centre, Autonomous haulage systems , Automated drilling system, Fleet Management System: TDS, CMMS, ERP for Mining Industry, Mining Remote Operations & Control: Robotics & Armchair Mining	6	The automation system in mine production and available system.
2	Overview of Material Handling Systems - Principles and Design Consideration, Material Transport Systems, Storage Systems. (DCS - automation)	4	The automation system in material transport and handling.
3	Automated Communication and Tracking Technologies: Proximity Systems, GNSS/UPS, Vision Based Systems,	5	The sensors and automation tools for implementing
Sl. No.	**Major Topics**	**No. of Lectures**	**Learning outcomes**
	Radar Systems, RFID and Geo-fencing, CCD camera, Data Logging Systems, SCADA, Image Processing etc.		automation in mine.
4	Virtual Reality Applications: Mining Equipment Concept development, Mine Safety Applications, Mining operation simulations	5	Visualisation of mining process for safe mine operations.
5	Descriptive Statistics: Introduction to the course; Probability Distributions Inferential Statistics: Inferential Statistics through hypothesis tests, Regression & ANOVA, Machine Learning: Introduction and Concepts, Differentiating algorithmic and model based frameworks Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification Supervised Learning with Regression and Classification techniques, Bias-Variance Dichotomy Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines	6	Learning descriptive statistics and machine learning for implementing automation and analytics.

5	Supervised Learning with Regression and Classification techniques, Ensemble Methods: Random Forest, Neural Networks, Deep learning, Unsupervised Learning and Challenges for Big Data Analytics: Clustering, Associative Rule Mining, Challenges for big data analytics: Applications of ANN and other tools in Mine operation and maintenance.	6	Develop understanding on supervised learning and deep learning algorithm to analyze big data for decision making.
6	Application of Big Data Analytics and Artificial Intelligence (AI) in Mining; Use Case studies on Cognitive Maintenance, Ore body modelling and Mine Design etc.	7	Application of Big Data and AI in Mining
	Total	39	

Reference Books

1. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger.Applied statistics and probability for engineers. John Wiley & Sons, 2010
3. G. Almgren, U. Kumar, N. Vagenas : Mine Mechanization & Automation 1st Edition
4. J. O'Shea M. Polis : Automation in Mining, Mineral and Metal Processing (1st Edition), Proceedings of The 3Rd Ifac Symposium, Montreal, Canada 18-20 August 1980
5. Peter V. Golde : Implementation of Drill Teleoperation in Mine Automation