Course Type	Course Code	Name of Course	L	T	P	Credit
DE9	**MND 408**	**INNOVATIVE MINING SYSTEMS**	3	0	0	9

Course Objective

This course will deal with all the classical and new methods for stimulating the creativity in mining and other business organizations. A number of innovations, the world has witnessed, which have changed the life of human beings in the society and also in the industry will be discussed in the class. Different technology and management tools employed for triggering innovations in mining and other organizations will be dealt, so that students will have the broad knowledge of the same for implementation in the organizations for which they will be serving in future.

Learning Outcomes

Upon successful completion of this course, students will:

- have a broad understanding of the need of innovation mining and allied industries.
- have detailed understanding of all the methods for stimulating creativity in mining organizations.
- be able to understand the current technological needs for improving organization performance.
- be in a position to visualize the new frontiers of mining including automation and robotics.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Unit – 1: Technological innovations and technology development :** Technology, invention, innovation, research and development - definitions, Types of Innovations and their impact on society. Technology life cycle curve, Long wave economic theory and its impact on development of technology. A case study on hierarchical process of innovation. Classical methods for stimulating creativity in an organization.	6	Understanding different conceptual definitions related to research, development, innovations and technology development. In addition, the students will learn the different classical methods of stimulating creativity in the organization.
2	**Unit – 2 : System concepts for innovative mining, Current technological needs for improving organization performance:** Innovations and business organization; New methods for stimulating creativity in mining and other organizations with case studies: Need pull and technological push, Unexpected occurrences, Incongruities, Process needs, Industry market changes, Demographic changes, Change in perception, New knowledge. Possible application of System dynamics, Value engineering and value analysis, Just in time (JIT) and Balanced Score Card.	9	The students will learn advanced methods for stimulating creativity with case studies. In addition, they will also learn different methods for improving the performance of the organization by application of advanced techniques.
3	**Unit – 3 : Innovations in mining operations:** Innovations in unit operations in surface and underground mining; Developments in hard rock mining; New developments in longwall mining	6	The students will learn different innovations in mining operations, which have impacted for significant improvement of

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	and Developments in mine ventilation systems.		performance of mining industry.
4	**Unit – 4 : New frontiers of mining:** Mining in deep sea, outer space and Antarctica; Oil mining; Extraction of coal bed methane.	5	The students will know the details of new frontiers of mining and also its need for global economy.
5	**Unit – 5 : New challenges of mining and climate change:** Mining and its contribution to global warming, Alpine hot box experiment, the atmosphere as a dam built across a river, Royal Institution Laboratory and findings of John Tyndall, findings of Guy Callendar, Arrhenius etc., the age of discovery: findings of Roger Rivelle, Keelings Curve, Large scale geophysical experiments, Modeling of climate and road to Rio	6	To understand the new challenges of mining, global warming and climate change and also the major contributions by different researchers.
6	**Unit – 6 : Automation and robotics:** Development of robotic systems, different types and possible contributions.	4	The students will understand the development and application of automation and robotic systems in mining industry.
7	**Unit – 6 : Case studies and critical analyses:** Events that shook the world and produced major innovations, Gulf war and innovations, China- growth and anxiety, Case studies and critical analyses, seminars and discussions.	6	The students will visualize the effect of different major changes in the world triggering innovations and the relation between growth and anxiety of a nation.

Text Books

1. Technological innovation and forces for change in the mineral industry, National Academy of Sciences, Washington D. C. 1978.
2. Technological policies in the Canadian Mineral Industry, Centre for Resources Studies, Queen's University; 1986.

Reference Books:

1. Proceedings of 1st, 2nd and 3rd International Conferences on Innovative Mining Systems.
2. Proceedings of 12th, 13th, 14th, 15th World Mining Congress.
3. Proceedings of 1st, 2nd, 3rd and 4th International Mine Congress.
4. Twiss, B. C., Managing Technological Innovation, Longman, 1974.