JHARKHAND Rai University RANCHI

BACHELORS OF TECHNOLOGY
(B.Tech)
MINING ENGINEERING

SESSION-2025-2029

SYLLABUS

JHARKHAND Rai University RANCHI

Vision of Department

To maintain the standard of mining education and commitment to produce quality human resource in the diverse field of mining, excavation engineering and other interdisciplinary areas and continuously striving to be recognized a centre for excellence for education, research and service to the mining and allied industry.

Mission of Department

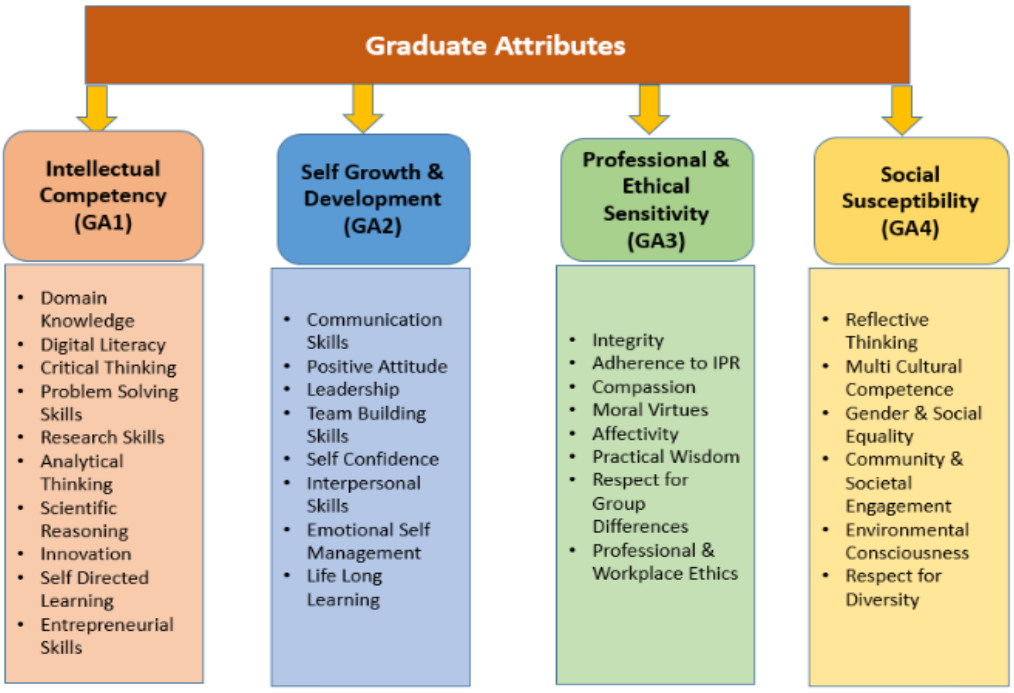
- To graduate well-educated mining engineers with sound technical knowledge and with ethical values who could excel in Mining Sector.
- To strive for excellence in academics, research and technology and contribute to the development of region and the nation in the area of mining engineering through continuous up gradation of facilities.
- To create human resource for developing and adopting appropriate technology in mining towards sustainable development and safe extraction of mineral resources.

GRADUATE ATTRIBUTES

Jharkhand Rai University is a mecca of transformative education which strongly believes in the holistic development of students. The university provides the cutting-edge of holistic learning to develop promising youngsters into leaders of tomorrow with globally relevant, future-ready and actionable intelligence. The objective of the Department is to make each student proficient in synthesizing/analyzing information and be ethical, socially responsible, and just when making decisions. JRU ensures inclusive and equitable quality education and promote lifelong learning opportunities for all.

Every graduate of the Department will be developed to possess the following attributes:

1. Intellectual Competency
2. Self-Growth & Development
3. Professional & Ethical Sensitivity
4. Social Susceptibility



PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEOs (Program Educational Objectives) relate to the career and professional accomplishments of passed out students after their graduation from the program. However, keeping the significance of contribution of the curriculum and the assessment opportunities such as examination and evaluation results, placement data, employer feedback and higher education entrance performance etc. are taken as tools for supplementary evidence to assess PEOs.

The program educational objectives of the undergraduate program in mining engineering take into consideration the university mission and the constituents' needs by producing graduates who will be able to:

- **PEO 1**-To develop graduates with technical knowledge, skill & competency in core mining fundamentals with special emphasis on blasting, mine planning, designing, execution and monitoring of various mining processes and systems.

- **PEO 2**- To prepare the graduates to enter careers in PSUs or employed in leading companies in mining or related fields to achieve professional growth.

- **PEO 3**- To exhibit the professional skills such as effective communication, leadership and team spirit in their choosen career and recognize the ethical & moral responsibilities to make informed judgment considering the impact of engineering solutions in economic , environmental & societal contexts.

- **PEO 4**- To demonstrate an understanding of the critical role mining engineers plays in society with respect to health, safety, and the environment in tangible ways such as achieving professional licensure.

- **PEO 5** -To pursue lifelong learning or acquire advanced degree in mining related field to assimilate new information and exposure to cutting edge technology.

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PROGRAMME OUTCOME (PO)

The graduates of the mining engineering program will be able to:

- **PO 1**
  Engineering knowledge: Develop necessary background in fundamental engineering concepts for demonstrating basic knowledge in their specialization involving complex engineering problems.

- **PO 2**
  Problem analysis: Develop the ability to design and conduct experiments, interpret and analyze complex engineering problems reaching substantiated conclusions.

- **PO 3**
  Design: Execute the aptitude to design a mining system that meets desired specifications and requirements of industrial applications & research projects.

- **PO 4**
  Conduct investigations of complex problems: Design and conduct experiments, as well as do research, analyze and interpret data and give clear solutions.

- **PO 5**
  Modern tool usage: Ability to use the techniques, skills, and modern engineering tools necessary for engineering practices with limitations.

- **PO 6**
  The engineer and society: Assess the local and global impact of engineering solutions on individuals, organization and society and the consequent responsibilities relevant to their professional engineering practice.

- **PO 7**
  Environment and sustainability: Gain knowledge in multi-disciplinary subjects to be a part of growing industry and will have a point of view regarding global scenario of the impact of mining technology on society and especially on environment.

- **PO 8**
  Ethics: Develop skill to communicate effectively in both orally and in writing & understanding of professional and ethical responsibilities.

- **PO 9**
  Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- **PO 10**
  Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO 11**
  Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

- **PO 12**
  Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOME (PSO)

- **PSO 1**-Apply principles of mine engineering for designing and developing solutions to problems in the field of minerals extraction, processing, exploration, excavation, geology, metallurgy & geotechnical engineering.

- **PSO 2-** Demonstrate their technical abilities, insights and skills creatively and productively in field of Mining Engineering and practice effectively as professional engineers, managers, and leaders in the mining Industries and/or a wide variety of other fields as engineers.

- **PSO 3-** Engage in independent and lifelong learning the technological advancements in the field of mine engineering and use the technology to analyze and provide sustainable solutions to the challenges in mining sector.

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MAPPING OF PEO WITH PO

PROGRAM EDUCATIONAL OBJECTIVE (PEO)	PROGRAM OUTCOME (PO)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PEO 1	H	H	M		H							
PEO 2						M					M	
PEO 3							M	M	M	M		
PEO 4						L	H				L	
PEO 5				L	L							M

MAPPING OF PEO WITH PSO

PROGRAM EDUCATIONAL OBJECTIVE (PEO)	PROGRAM SPECIFIC OUTCOME (PSO)		
	PSO 1	PSO 2	PSO 3
PEO 1	H		
PEO 2		M	
PEO 3		L	
PEO 4			M
PEO 5			M

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COURSE COMPONENTS

COURSE COMPONENT	Curriculum Content (Total no. of credits of the programme)	Curriculum Content (% of total credits of the programme)	PEO`s	PO`s
Core Courses (CC)-Major	80	48.48	PEO 1 & PEO 2	PO 1
Core Courses (CC)-Minor	30	18.18	PEO 1 & PEO 2	PO 1 & PO 2
Multidisciplinary Course (MDC)	15	9.09	PEO 1, PEO 3 & PEO 4	PO 7, PO 8, PO 9 & PO 10
Ability Enhancement Courses (AEC)	7	4.24	PEO 3 & PEO 4	PO 7
Value Added Course (VAC)	11	6.67	PEO 1, PEO 2 & PEO 5	PO 2, PO 3, PO 4, PO 5, PO 10 & PO 11
Skill Enhancement Course (SEC)	7	4.24	PEO 2, PEO 4	PO 6, PO 7 & PO 12
Summer Internship Course	3	1.82		
Project	12	7.27		

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COURSE SCHEME

COURSE SCHEME															
BATCH 2025-2029															
BTECH IN MINING ENGINEERING															
SEMESTER I															
S. No	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Periods			Credit
						Assignment	TA	Total	ESE		L	T	P	
1	4.5	Basic Science Course	Multidisciplinary Course (MDC)	8BSC101	Physics	20	10	30	70	100	3	1	0	4
2		Basic Science Course	Multidisciplinary Course (MDC)	8BSC102	Mathematics I	20	10	30	70	100	3	1	0	4
3		Engineering Science Course	Core Course (CC)- Minor	8ESC101	Basic Electrical Engineering	20	10	30	70	100	3	1	0	4
4		Engineering Science Course	Core Course (CC)- Minor	8ESC102	Engineering Graphics & Design	20	10	30	70	100	2	0	0	2
5		Humanities and Social Sciences	Ability Enhancement Courses (AEC)	8HSMC101	English	20	10	30	70	100	2	0	2	3
PRACTICAL /SESSIONAL														
1	4.5	Basic Science Course	Skill Enhancement Course (SEC)	8BSC101P	Physics Lab			30	20	50	0	0	2	1
2		Engineering Science Course	Skill Enhancement Course (SEC)	8ESC101P	Basic Electrical Engineering Lab			30	20	50	0	0	2	1
3		Engineering Science Course	Skill Enhancement Course (SEC)	8ESC102P	Engineering Graphics & Design Lab			30	20	50	0	0	2	1
								TOTAL		650				20

BATCH 2025-2029															
BTECH IN MINING ENGINEERING															
SEMESTER II															
S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Periods			Credit
						Assignment	TA	Total	ESE		L	T	P	
1	4.5	Basic Science Course	Multidisciplinary Course (MDC)	8BSC103	Chemistry	20	10	30	70	100	3	0	0	3
2		Basic Science Course	Multidisciplinary Course (MDC)	8BSC104	Mathematics II	20	10	30	70	100	3	1	0	4
3		Engineering Science Course	Core Course (CC)- Minor	8ESC103	Programming for Problem Solving	20	10	30	70	100	3	0	0	3
4		Engineering Science Course	Core Course (CC)- Minor	8ESC104	Workshop Practice	20	10	30	70	100	2	0	0	2
5		Mandatory Course	Core Course (CC)- Minor	8MC101	Environmental Science	20	10	30	70	100	3	0	0	3
6		Humanities and Social Sciences	Value Added Course (VAC)	8VAC101	Character Building and Holistic Development of Personality 1 (Spritual & Mental Health)	40	10	50	50	100	2	0	0	2
PRACTICAL /SESSIONAL														
1	4.5	Basic Science Course	Skill Enhancement Course (SEC)	8BSC103P	Chemistry Lab			30	20	50	0	0	2	1
2		Engineering Science Course	Skill Enhancement Course (SEC)	8ESC103P	Programming for Problem Solving Lab			30	20	50	0	0	2	1
3		Engineering Science Course	Skill Enhancement Course (SEC)	8ESC104P	Workshop Practice Lab			30	20	50	0	0	2	1
								TOTAL		750				20

NOTE: Mandatory Vocational /Industrial Training (4 Weeks) of 4 credits or any specialized course of minimum 4 credits for student opting for exit after first year with UG CERTIFICATE.

JHARKHAND Rai University
RANCHI

BATCH 2025-2029

BTECH IN MINING ENGINEERING

SEMESTER III

S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Period			Credit
						Assignment	T A	Total	ESE		L	T	P	
1	5.0	Basic Science Course	Core Course (CC)- Minor	8BSC201	Mathematics III	20	10	30	70	100	3	0	0	3
2		Professional Core Courses	Core Course (CC)- Minor	8ESC201	Engineering Mechanics	20	10	30	70	100	3	0	0	3
3		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE201	Elements of Mining Technology	20	10	30	70	100	3	0	0	3
4		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE202	Mining Geology I	20	10	30	70	100	3	0	0	3
5		Engineering Science Courses	Core Course (CC)- Minor	8PCCMiE203	Basic Mine Surveying	20	10	30	70	100	3	0	0	3
6		Humanities and Social Sciences	Ability Enhancement Courses (AEC)	8HSMC201	Effective Technical Communication	20	10	30	70	100	3	0	0	2
7		University Mandatory Courses	Value Added Course (VAC)	8UMC102	**Community Engagement and Social Responsibility	40	10	50	50	100	1	0	2	2
PRACTICAL/ SESSIONAL														
1	5.0	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE202P	Mining Geology I Lab			30	20	50	0	0	2	1
2		Professional Core Courses	Core Courses (CC)- Minor	8PCCMiE203P	Basic Mine Surveying Lab			30	20	50	0	0	2	1
								TOTAL		800				21

BATCH 2025-2029

BTECH IN MINING ENGINEERING

SEMESTER IV

S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Period			Credit
						Assignment	T A	Total	ESE		L	T	P	
1	5.0	Professional Core Courses	Core Courses (CC)- Minor	8ESC202	Thermodynamics & Fluid Mechanics	20	10	30	70	100	3	0	0	3
2		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE204	Elements of Rock Mechanics	20	10	30	70	100	3	0	0	3
3		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE205	Mining Geology II	20	10	30	70	100	3	0	0	3
4		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE206	Surface Mining	20	10	30	70	100	3	0	2	3
5		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE207	Mine Surveying & Geospatial Technology	20	10	30	70	100	3	0	0	3
6		Engineering Science Courses	Core Courses (CC)- Major	8PCCMiE208	Drilling & Blasting Technology	20	10	30	70	100	3	0	0	3
7		Humanities and Social Sciences	Value Added Course (VAC)	8VAC201	Character Building and Holistic Development of Personality 2 (Yoga and Physical Fitness)	40	10	50	50	100	2	0	0	2
PRACTICAL/ SESSIONAL														
1	5.0	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE204P	Elements of Rock Mechanics Lab			30	20	50	0	0	2	1
2		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE205P	Mining Geology II Lab			30	20	50	0	0	2	1
3		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE207P	Mine Surveying & Geospatial Technology Lab			30	20	50	0	0	2	1
								TOTAL		850				23

Vocational Training in a Surface / Underground Mine of minimum 30 (Thirty) days to be taken at the end of IVth Semester Will be Credited in Vth Semester.

NOTE: Mandatory Vocational /Industrial Training (4 Weeks) of 4 credits or any specialized course of minimum 4 credits for student opting for exit after first year with UG DIPLOMA.

JHARKHAND Rai University
RANCHI

BATCH 2025-2029

BTECH IN MINING ENGINEERING

SEMESTER V

S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Period			Credit
						Assignment	T A	Total	ESE		L	T	P	
1	5.5	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE301	Mining Machinery I	20	10	30	70	100	3	0	0	3
2		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE302	Mines & Mineral Economics	20	10	30	70	100	3	0	0	3
3		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE303	Underground Coal Mining	20	10	30	70	100	3	0	0	3
4		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE304	Operational Research in Mining	20	10	30	70	100	3	0	0	3
5		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE305	Ventilation & Climate Control	20	10	30	70	100	3	0	0	3
6		**OPEN ELECTIVE COURSE I(Any one of the following subjects)**				20	10	30	70	100	3	0	0	3
		Open Elective Courses	Value Added Course (VAC)	8OEC301	Indian Knowledge System (IKS)- Concepts and Applications in Engineering									
		Open Elective Courses	Value Added Course (VAC)	8OEC302	Plastic Waste Management									
		Open Elective Courses	Value Added Course (VAC)	8OEC303	Enterprenurship									
		Open Elective Courses	Value Added Course (VAC)		Any subject from MOOCS									
PRACTICAL / SESSIONAL														
1	5.5	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE305P	Ventilation & Climate Control Lab			30	20	50	0	0	2	1
2		Project	Summer Internship Course	8PROJMiE301	Vocational Training Report			50	50	100	0	0	0	3
								TOTAL		**750**				**22**

BATCH 2025-2029

BTECH IN MINING ENGINEERING

SEMESTER VI

S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Period			Credit
						Assignment	T A	Total	ESE		L	T	P	
1	5.5	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE306	Mining Machinery II	20	10	30	70	100	3	0	0	3
2		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE307	Underground Metal Mining	20	10	30	70	100	3	0	0	3
3		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE308	Advanced Underground Mining	20	10	30	70	100	3	0	0	3
4		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE309	Applied Rock Mechanics	20	10	30	70	100	3	0	0	3
5		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE310	Mine Environmental Engineering	20	10	30	70	100	3	0	0	3
6		Humanities and Social Sciences	Value Added Course (VAC)	8VAC301	Character Building and Holistic Development of Personality 3 (Universal Human Values and Ethics)	40	10	50	50	100	2	0	0	2
7		**OPEN ELECTIVE COURSE II (Any one of the following subjects)**				20	10	30	70	100	3	0	0	3
		Open Elective Courses	Core Courses (CC)- Minor	8OEC304	Data Analytics									
		Open Elective Courses	Core Courses (CC)- Minor	8OEC305	Mine Automation & IOT									
		Open Elective Courses	Core Courses (CC)- Minor	8OEC306	Mine Electrical Engineering									
		Open Elective Courses	Core Courses (CC)- Minor		Any subject from MOOCS									
PRACTICAL / SESSIONAL														
1	5.5	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE309P	Applied Rock Mechanics Lab			30	20	50	0	0	2	1
2		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE310P	Mine Environmental Engineering Lab			30	20	50	0	0	2	1
2		Professional Core Courses	Skill Enhancement Course (SEC)	8PCCMiE311P	Computer Aided Mine Planning Lab			30	20	50	0	0	2	1
								TOTAL		**850**				**23**

JHARKHAND Rai University
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BATCH 2025-2029																
BTECH IN MINING ENGINEERING																
SEMESTER VII																
S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Period			Credit
						Assignment	T A	Total	ESE		L	T	P	
1	6.0	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE401	Mine Legislation & Safety I	20	10	30	70	100	3	0	0	3
2		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE402	Mine Hazards & Risk	20	10	30	70	100	3	0	0	3
3		Professional Core Courses	Core Courses (CC)- Major	8PCCMiE403	Mine Planning	20	10	30	70	100	3	0	0	3
4		DEPARTMENTAL ELECTIVE COURSE I (Any one of the following subjects)				20	10	30	70	100	3	0	0	3
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE401	Mine Closure									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE402	Dimensional Stone Mining									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE403	Design of Open Pit Mines									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE404	Mine Management									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE405	Mine Ventilation Planning									
5		Humanities and Social Sciences	Ability Enhancement Courses (AEC)	8HSMC401	**Seminar in Executive Communication	20	10	30	20	50	2	0	0	2
PRATICAL / SESSIONAL														
1	6.0	Project	Project	8PROJMiE401	Mining Project Work I			100	100	200	0	0	3	6
								TOTAL		650				20

** Only Viva Voce will be conducted.

BATCH 2025-2029																
BTECH IN MINING ENGINEERING																
SEMESTER VIII																
S.No.	NSQF/ NATIONAL CREDIT FRAMEWORK NCrF CREDIT LEVEL	BROAD CATEGORY	CATEGORY	CODE	COURSE TITLE	Evaluation Scheme				Subject Total	Period			Credit
						Assignment	T A	Total	ESE		L	T	P	
1	6.0	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE404	Mine Legislation & Safety II	20	10	30	70	100	3	0	0	3
2		Professional Core Courses	Core Courses (CC)- Major	8DECMiE405	Mineral Processing Technology	20	10	30	70	100	3	0	0	3
3		DEPARTMENTAL ELECTIVE COURSE II (Any one of the following subjects)				20	10	30	70	100	3	0	0	3
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE406	Mine Reclamation & Rehabilitation									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE407	Clean Coal Technology									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE408	Coal bed Methane Mining									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE409	Socio Economic Impacts of Opencast Mines									
		Departmental Elective Course	Core Courses (CC)- Major	8DECMiE410	Sustainable Mining Practices									
4		University Mandatory Course	Value Added Course (VAC)	8UMC101	***Managing Personal Finance	40	10	50	0	50	1	0	0	0
PRACTICAL / SESSIONAL														
1	6.0	Professional Core Courses	Core Courses (CC)- Major	8PCCMiE405P	Mineral Processing Technology Lab			30	20	50	0	0	2	1
2		Project	Project	8PROJMiE402	Mining Project Work II			100	100	200	0	0	6	6
								TOTAL		600				16

JHARKHAND Rai University RANCHI

DETAILED ASSESSMENT SCHEME

Assessment Scheme					
CIA- Continuous Internal Assessment (50 Marks)					
Assessment Parameters	**Assessment Tools**	**Marks**	**Percentage (%)**	**Bloom's Taxonomy Category**	**Bloom's Taxonomy Level LOT/HOT**
Assignment 1	Assignment consisting of minimum 5 Questions	10	20	Remember, Understand, Apply	LOT
Assignment 2	Assignment consisting of minimum 2 Questions	10		Analyze, Evaluate, Create	HOT
Class Participation	Brainstorming, Discussion, Attendance, Extempore or any other activity	5	10		
EC&CC Activities	Extracurricular & Co-Curricular activities	5			

ESE- End Semester Examination (70 Marks)			
Bloom's Taxonomy Category	**ESE Question Paper Section**	**Percentage (%)**	**Bloom's Taxonomy Level LOT/HOT**
Remember	A	30	LOT
Understand	A		
Apply	B	40	LOT/ HOT
Analyze	B		
Evaluate & Create	C	30	HOT

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RANCHI

SEMESTER I

Program: B.Tech
Semester: First
Course: Physics
Course Code: 8BSC101

L	T	P	C
3	1	0	4

Course Learning Objective:

The objective of this course is

CLO 1: To understand the students with the concepts of Electromagnetic Theory and applications of Electromagnetic Theory.

CLO 2: To understand the theory of Quantum Mechanics.

CLO 3: To apply the theory of Mechanics.

CLO 4: To illustrate the different Phenomena of Wave Optics.

CLO 5: To explain Laser, types of Laser and applications of Laser.

CLO 6: To understand the concept of Semiconductor Physics and Semiconductor devices.

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: Apply the basic concepts of electromagnetic theory.

CO2: Explain the dual nature of matter and wave equation.

CO3: Demonstrate the types of motion and different types of forces.

CO4: Describes the different Phenomena of Wave Optics, principles of lasers, types of lasers and their application.

CO5: Design the different types of diodes.

Course Content:

Topics	Hours
Unit 1: Introduction to Electromagnetic Theory	**10**
Laplace's and Poisson's equations for electrostatic potential and. Boundary conditions of electric field and electrostatic Potential. Energy of a charge distribution and its expression in terms of electric field. Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, Bio-Savart law, Divergence and curl of static magnetic field; Magnetization magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials. Faraday's law in terms of EMF produced by changing magnetic flux, Lenz's law. Differential form of Faraday's law Displacement current and Maxwell's equations.	
Unit II: Quantum Mechanics	**7**
Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Uncertainty principle. Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in three dimensional box.	
Unit III: Introduction to Mechanics	**8**
Scalars and vectors Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; F = - Grad V; Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.	
Unit IV: Oscillation, Waves and Optics	**8**
Mechanical and electrical simple harmonic oscillators. Brewster's Law, total internal reflection, Mirrors & lenses and optical instruments based on them. Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne), solid-state lasers (ruby Laser).Properties of laser beams, applications of lasers in science, engineering and medicine.	
Unit V: Semiconductor Physics	**7**
P-N junction, Metal-semiconductor junction (Ohmic and Schottky); Carrier transport, generation, and recombination; Semiconductor materials of interest for optoelectronic devices. Rates of optical transitions LED: device structure, materials, characteristics, and figures of merit. Types of semiconductor photodetectors -p-n junction, PIN, and Avalanche.	

Suggested Reading:

1. *Engineering Physics : R.K.Gaur & S.L. Gupta*
2. *Engineering Physics : G.S. Raghuvanshi*
3. *Modern Engineering Physics: A.S.Vasudeva*
4. *Halliday and Resnick, Physics*
5. *D. J. Griffiths, Quantum*
6. *D. J. Griffiths, "Quantum mechanics", Pearson Education.*
7. *S. M. Sze, Semiconductor Devices: Physics and Technology.*

Program: B.Tech
Semester: First
Course: Physics I
Course Code: 8BSC101P

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0	0	2	1

List of Laboratory Experiments/Demonstrations:

1. Find the acceleration due to gravity using Kater's pendulum.
2. Find the resistance of a given wire using Meter Bridge.
3. To establish the current voltage relationship for a metallic conductor and find its resistance.
4. To determine the unknown resistance of given wire using Potentiometer.
5. Find the acceleration due to gravity using Simple pendulum.
6. To determine Young' modulus of the material of a given wire using Searle's Apparatus.
7. To determine the wavelength of sodium light by Newton's ring method.
8. To measure the wavelength of Mercury spectrum using Spectrometer grating.
9. To study the variation of magnetic field with distances using Helmholtz Galvanometer.

Program: B.Tech
Semester: First
Course: Mathematics I
Course Code: 8BSC102

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Course Learning Objective:

To familiarize the student with:
CLO 1: The mathematical tools needed in evaluating multiple integrals and their usage. .
CLO 2: The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
CLO 3: The tool of Multivariate Calculus for learning advanced Engineering Mathematics.
CLO 4: To deal with functions of multiple integration that are essential in most branches of engineering.
CLO 5: The essential tool of sequences and series in a comprehensive manner.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Caylay Hamilton Theorem to find inverse of matrix which is very important in many engineering application
CO 2: Ability to understand calculus and its application in engineering.
CO 3: Gain knowledge about multiple differentiation which is helpful in Engineering & it is also useful in Research & Development.
CO 4: Gain knowledge about multiple Integration which is helpful in Engineering & it is also useful in Research & Development.
CO 5: Appreciate knowledge of sequences and series and its application in real world problems.

Course Content:

Topics	Hours
Unit 1: Matrices	**6**
System of linear equations; rank of a matrix, rank-nullity theorem; Symmetric, skew symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation; Cramers rule.	
Unit II: Calculus	**6**
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule, Evalution of definite and improper integrals; Beta and Gamma functions and their properties.	
Unit III: Multivariable Calculus (Differentiation)	**6**
Partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points, Method of Lagrange multipliers.	
Unit IV: Multivariable Calculus (Integration)	**8**
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes and sphere.	
Unit V: Sequences and series	**6**
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and Logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	

Suggested Reading:

1. *H.K. Dass, "Advance Engineering Mathematics''; S.Chand &Co., 9th Revised Ed., 2001.*
2. *B.S. Grewal, "Higher Engineering Mathematics''.*
3. *E. Kreyszig, "Advance Engineering*

Program: B.Tech
Semester: First
Course: Basic Electrical Engineering
Course Code: 8ESC101

L	T	P	C
3	1	0	4

Course Learning Objective:

CLO 1: To study the electrical circuit network with DC Excitation.
CLO 2: To understand phasor diagram of different electrical circuit for AC Excitation.
CLO 3: To Understand different types of transformer with single phase & three phase connection.
CLO 4: To study the construction & working principles of different types Electrical Machine.
CLO 5: To understand the power converters with switch gear protection for electrical equipment's, Earthing & types of battery.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Demonstrate and apply basics of electrical circuit theorms on D.C Supply & A.C waveform with the Phasor diagram & power measurement.
CO2: Apply fundamentals of electromagnetism and basic concept of single-phase & three phase transformer with their regulation, efficiency and estimation of losses.
CO3: Realize the concept and working of different types of DC and AC machines and will be able to select right machine to meet desired needs for implementing engineering solutions.
CO4: Understand the basic circuits converters, inverters, Switchgear protection, earthing & types of battery.

Course Content:

Topics	Hours
Unit I: D.C. Circuits	**8**
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	
Unit II: A.C. Circuits	**8**
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	
Unit III: Transformers	**6**
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.	
Unit IV: Electrical Machines	**8**
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	
Unit V: Power Converters	**6**
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	
Unit VI: Electrical Installations	**6**
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	

Suggested Reading:

1. *Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.*
2. *Basic Electrical Engineering - D.C. Kulshreshtha, 2009, Tata McGraw Hill.*
3. *Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011*
4. *Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010*
5. *Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989*

Program: B.Tech
Semester: First
Course: Basic Electrical Engineering Lab
Course Code: 8ESC101P

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List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. To determine the characteristics of PN junction diode.
3. Verification of Thevenin's Theorem.
4. Verification of Norton's Theorem
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. To determine the equivalent resistance in series and parallel.
7. Verification of KVL and KCL.
8. To verify ohm's law.
9. Verification of Superposition theorem.

Program: B.Tech
Semester: First
Course: Engineering Graphics & Design
Course Code: 8ESC102

L	T	P	C
2	0	0	2

Course Learning Objective:

CLO 1: Introduction to engineering design and its place in society
CLO 2: Exposure to the visual aspects of engineering design
CLO 3: Exposure to engineering graphics standards
CLO 4: Exposure to solid modeling
CLO 5: Exposure to computer-aided geometric design
CLO 6: Exposure to creating working drawings
CLO 7: Exposure to engineering communication

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: To know and understand the conventions and the method of engineering drawing.
CO 2: To know the Orthographic & Isometrics projections.
CO 3: To know the various projections of regular solids, Sections and Sectional Views of Right Angular Solids.
CO 4: To improve visualization skills so that student can apply these skill in developing new products.
CO 5: To know about graphical communication and various graphical drawing tools.
CO 6: To know the creation of engineering models and their presentation in standard 2D & 3D forms.

Course Content:

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Topics	Hours
Unit I:	**4**
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales.	
Unit II:	**3**
Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes.	
Unit III:	**3**
Projections of Regular Solids covering, those inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale.	
Unit IV:	**4**
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.	
Unit V:	**3**
Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions	
Unit VI:	**5**
Overview of Computer Graphics covering, demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System, The Status Bar.	
Unit VII:	**4**
Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits.	
Unit VIII:	**5**
Annotations, layering & other functions covering applying dimensions to objects, Changing line lengths through modifying existing lines (extend/lengthen); Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface. Dimensioning	

guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.	
Unit IX:	**5**
Creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; Introduction to Building Information Modelling (BIM).	

Suggested Reading:

1. ***Engineering Drawing textbook Intro By : N D Bhatt***
2. *Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House*
3. *Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education*
4. *Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication*
5. *Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers*
6. ***(Corresponding set of) CAD Software Theory and User Manuals By: R K Dhavan***

Program: B.Tech
Semester: First
Course: Engineering Graphics & Design Lab
Course Code: 8ESC102P

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List of Experiments:

1.Introduction to Engineering Drawing
2.To study Orthographic Projections
3.To study Isometric Projections
4.To study Projection of Point
5.To study Projection of Line
6.To study Projection of Plane
7.To study Projection of Solids
8.To study Projection of Section of Solids
9.To study Projection of Development of Surfaces
10.To study Projection of Scales

Program: B.Tech
Semester: First
Course: English
Course Code: 8HSMC101

L	T	P	C
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Course Learning Objective:

The objectives of the course are:
CLO 1: To enhance Professional competence in reading, writing, listening and speaking.
CLO 2: Switch the approach from providing information about the language to use the language.
CLO 3: To use English effectively for study purpose across the curriculum;
CLO 4: To revise and reinforce structure already learnt.
CLO 5: Introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centered learning rather than on the teacher-centered learning.
CLO 6: Ability to master three major forms of communications which are vital in academic and professional settings namely professional presentations, interviews and group communications respectively.
CLO 7: Providing a deep insight into the techniques for delivering effective presentations, winning job interviews, and actively participating in various forms of group communication.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: To design a language component or process to meet desired need within realistic, constraints.
CO 2: To analyze the usage of English words in different contexts.
CO 3: Develop an understanding of technical and academic articles' comprehension.
CO 4: To present oneself at multinational levels knowing the type of different standards of English
CO 5: Students will be made to evaluate the correct and error- free writing by being well viewed in rules and cultivate relevant style of communication & presentation at their work place and also for academic.
CO 6: Students will apply it for practical and oral presentation with its presentation skills and voice dynamics.

Course Content:

Topics	Hours
Unit I: Vocabulary Building	**5**
1.1 The concept of Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations.	
Unit II: Basic Writing Skills	**5**
2.1 Sentence Structures 2.2 Use of phrases and clauses in sentences 2.3 Importance of proper punctuation 2.4 Creating coherence 2.5 Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	
Unit III: Identifying Common Errors in Writing	**5**
3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	
Unit IV: Nature and Style of sensible Writing	**5**
4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	
Unit V: Writing Practices	**4**
5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing	
Unit VI: Oral Communication	**6**
(This unit involves interactive practice sessions in Language Lab) 6.1 Listening Comprehension 6.2 Pronunciation, Intonation, Stress and Rhythm 6.3 Common Everyday Situations: Conversations and Dialogues 6.4 Communication at Workplace 6.5 Interviews 6.6 Formal Presentations	

Suggested Readings:

1. *Practical English Usage. Michael Swan. OUP. 1995.*
2. *Remedial English Grammar. F.T. Wood. Macmillan.2007*
3. *On Writing Well. William Zinsser. Harper Resource Book. 2001*
4. *Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.*
5. *Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.*

JHARKHAND Rai University
RANCHI

SYLLABUS
SEMESTER II

B.TECH
IN
MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Second
Course: Chemistry
Course Code: 8BSC103

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3	0	0	3

Course Learning Objective:

CLO 1: To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
CLO 2: The knowledge gained on spectroscopy, stereochemistry will provide a strong platform to understand the concepts on these subjects for further learning
.**CLO 3:** To acquire knowledge of the basic 3D structure in organic chemistry including stereochemistry, aromaticity and reaction mechanism.
CLO 5: To develop knowledge on the physical state and electrochemistry of molecules and significance of corrosion.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Learn about the bonding in a molecular structure of simple and complex molecule , magnetism and isomerism in complex molecule.
CO 2: Learn about limitations of classical mechanics and solution in terms of quantum mechanics for atomic/molecular systems. Gain insight into the basic principles of UV, IR and NMR spectroscopic techniques. Use spectroscopic techniques to determine structure and stereochemistry of known and unknown compounds.
CO 3: Learn about aromaticity of organic compound identify and differentiate prochirality and chirality at centres, axis and determine the absolute configuration. Evaluate the stability of various conformers of acyclic and cyclic systems
CO 4: Learn about the rate of reaction, order and molecularity of reaction, mechanism of a simple as well as catalytic reaction.
CO 5: Learn about the phases and the electrochemical behavior of the molecules, EMF of cell and it's application.

Course Content:

Topics	Hours
Unit I: : Chemical Bonding	**9**
Ionic bond: Radius ratio rule, Metallic Bond: valence bond and band theories, defects in solids, Werner's Theory, Bonding in Transition metal complexes, Ligands, coordination complexes, Crystal Field Theory, Octahedral and Tetrahedral complexes, CFSE, Jahn Teller theorem, magnetism, and isomerization in coordination compounds..	
Unit II: Spectroscopic techniques and applications	**4**
Principles of spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging.	
Unit III: Organic Structure and Stereochemistry	**9**
Covalent bond: Lewis structure, Valence Bond theory, Molecular orbital theory, Molecular orbital of diatomic and polyatomic system, hybridization, conjugated molecules, Huckel molecular orbital theory of conjugated systems. Isomerism, Geometrical isomerism: cis–trans and syn-anti isomerism; Optical isomerism & Chirality; Wedge, Fischer, Newmann and Sawhorse Projection formulae and interconversions; Conformational studies of ethane, n-butane, Cyclohexane	
Unit IV: Kinetics and Catalysis:	**9**
Order & molecularity of reactions, kinetics of zero, first & second order reaction Characteristics of catalyst, types of catalysis, theories of catalysis; Acid base catalysis, Enzyme catalysis, Important catalysts in industrial processes; Hydrogenation using Wilkinson's catalyst,	
Unit V: Phase and Chemical equilibrium	**9**
Phase Rule: Terms Involved, Phase diagram of one component (Water) their applications. Law of chemical equilibrium, equilibrium constants and their significance, Weak and strong electrolytes, Standard electrode potential and its application , EMF and its measurement and application, the Nernst equation , Chemical and Electrochemical corrosion, Factors affecting the rate of corrosion.	

Suggested Reading:

1. *University chemistry, by B. H. Mahan*
2. *Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane*
3. *Fundamentals of Molecular Spectroscopy, by C. N. Banwell*
4. *Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan*
5. *Physical Chemistry, by P. W. Atkins*
6. *Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore.*
7. *Engineering Chemistry by Jain & Jain.*
8. *Engineering Chemistry by O P Agarwal.*

Program: B.Tech
Semester: Second
Course: Chemistry Lab
Course Code: 8BSC103P

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List of Laboratory Experiments/Demonstrations:

1. Determination of surface tension and viscosity
2. To draw the pH-titration curve of strong acid vs strong base.
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductance of solutions
7. Synthesis of a polymer/drug
8. Saponification/acid value of an oil
9. Chemical analysis of a salt
10. Models of potential energy surfaces
11. Preparation of N/10 solution
12. Estimation of strength Hcl solution supplied by titrating it against N/10 NaOH solution.
13. Adsorption of acetic acid by charcoal

Program: B.Tech
Semester: Second
Course: Mathematics II
Course Code: 8BSC104

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3	1	0	4

Course Learning Objective:

CLO 1: The subject helps the students to develop the fundamentals and basic concepts of Differential Equation. Students will be able to solve problems related to engineering applications by using these techniques.
CLO 2: Apply the principles of Power series to solve a variety of practical problems in Engineering and Applied Science.
CLO 3: Apply the concept of Partial Differential Equation to solve various equations like wave equation, heat equation etc.
CLO 4: Apply the concept of line, surface and volume integral with various theorems to solve practical problems.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: To introduce the basic concepts required to understand, construct, solve and interpret ordinary differential equations.
CO 2: To teach methods to solve differential equations of various types.
CO 3: To give an idea about Power series solutions; Legendre polynomials, Bessel functions.
CO 4: To give an ability to apply knowledge of Partial Differential equation on engineering problems.
CO 5: Formulate and solve problems related to vector calculus in the field of Industrial Organization Engineering.

Course Content:

Topics	Hours
Unit I: First order ordinary differential equations	**6**
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	
Unit II: Ordinary differential equations of higher orders	**6**
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation.	
Unit III: Power series	**4**
Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	
Unit IV: Partial Differential Equations	**10**
Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates.	
Unit V: Vector calculus	**6**
Gradient, curl and divergence ; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	

Suggested Readings:

1. *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.*
2. *Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.*
3. *W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.*
4. *S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.*
5. *E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.*
6. *E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.*
7. *J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.*
8. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.*
9. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.*

Program: B.Tech
Semester: Second
Course: Programming for Problem Solving
Course Code: 8ESC103

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3	0	0	3

Course Learning Objective:

The objective of this course is to help the students
CLO 1: To impart basic knowledge about simple algorithms, fundamentals of Programming Skills particularly in C Programming Language.
CLO 2: To enable how to implement conditional branching, iteration and recursion.
CLO 3: To enable them to use functions, arrays, pointers, strings and structures in solving problems.
CLO 4: To understand how to solve problems related to matrices, searching, sorting, use files to perform read and write operations.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand the fundamentals of computer and C programming language, along with flow chart and algorithm to solve given program.
CO2: Able to choose the loops and decision-making statements to solve the problem.
CO3: Gain the knowledge of function, array , pointer and structure.
CO4: Learn about implementation of file Operations in C programming for a given application.

Course Content:

Topics	Hours
Unit 1: Introduction to Programming	**2**
Introduction to Programming (Flow chart/pseudocode, compilation etc.), Variables (including data types)	
Unit II: Arithmetic expressions	**2**
Arithmetic expressions and precedence	
Unit III: Conditional Branching and Loops	**8**
Writing and evaluation of conditionals and consequent branching, Iteration and loops.	
Unit IV: Arrays	**6**
Arrays (1-D, 2-D), Character arrays and Strings	
Unit V: Basic Algorithms	**6**
Searching, Basic Sorting Algorithms, Finding roots of equations, idea of time complexity	
Unit VI: Function and Recursion	**8**
Functions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc.	
Unit VII: Structure and Pointers	**6**
Pointers, Structures (including self referential structures e.g., linked list, notional introduction)	
Unit VIII: File handling	**2**

Suggested Reading:

1. *E. Balagurusamy – Programming in ANSI C, 3rd Edn. , TMH, New Delhi, 2004*
2. *Programming with C, B.S.Gottfried (TMH)*
3. *Y. Kanetkar – Let us C, 4th Edition, BPB Publication, New Delhi; 2002*
4. *The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education*
5. *C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press*
6. *Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice*

Program: B.Tech
Semester: Second
Course: Programming for Problem Solving
Course Code: 8ESC103P

L	T	P	C
0	0	2	1

Tutorial and Lab:

Tutorial 1: Problem solving using computers: Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions: Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings, memory structure: Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value: Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls: Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures

Tutorial 12: File handling: Lab 12: File operations

Program: B.Tech
Semester: Second
Course: Workshop Practice
Course Code: 8ESC104

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Course Learning Objective:

CLO 1: Students able to understand different tool &equipment for work shop practice.
CLO 2: Students acquire skills for the preparation of different Carpentry/fitting/welding models.
CLO 3: Students able to understand the safety precaution in the workshop
CLO 4: Student acquires skills of Application orientated tasks.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Understand the concepts of various manufacturing methods such as casting, forming machining.
CO 2: Understand the additive manufacturing with its implication in manufacturing.
CO 3: Ability to Produce Fitting jobs as per specified dimensions with the use of various fitting tools.
CO 4: Understand the basic concepts of electrical & electronics and understand the working principle of motors.
CO 5: Ability to understand the recyclable plastics & non-recyclable plastics and various manufacturing process & also understand the various additives & fillers used in plastics & its implications.
CO 6: Understand the various the types of welding such as Arc welding, TIG, MIG & various advanced welding & its practical implications in industrial arena.

Course Content:

Topics	Hours
Unit 1: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods	**3**
Unit II: CNC machining, Additive manufacturing	**1**
Unit III: Fitting operations & power tools	**1**
Unit IV: Electrical & Electronics	**1**
Unit V: Carpentry	**1**
Unit VI: Plastic moulding, glass cutting	**1**
Unit VII: Metal casting	**1**
Unit VIII: Welding (arc welding & gas welding), brazing	**1**

Suggested Reading:

8. *Workshop technology by Hajara Chaudhary*
9. *Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.*
10. *Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",*
11. *4th edition, Pearson Education India Edition, 2002.*
12. *(iii)Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.*
13. *Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.*
14. *Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.*

Program: B.Tech
Semester: Second
Course: Workshop Practice Lab
Course Code: 8ESC104P

L	T	P	C
0	0	2	1

Workshop Practice: **(60 hours)**

1. Machine shop- 10 hours
2. Fitting shop - 8 hours
3. Carpentry - 6 hours
4. Electrical & Electronics - 8 hours
5. Welding shop - 8 hours (Arc welding 4 hrs + gas welding 4 hrs)
6. Casting - 8 hours
7. Smithy- 6 hours
8. Plastic moulding & Glass Cutting - 6 hours

Program: B.Tech
Semester: Second
Course: Environmental Science
Course Code: 8MC101

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Knowledge: to help students, gain a variety of experiences and acquire a basic understanding of the environment and its associated problems.
CLO 2: Awareness: to help students acquire an awareness of and sensitivity to the total environment and its allied problems.
CLO 3: Attitudes: to help students to acquire a set of values and promote a feeling of concern for the environment and provide motivation for actively participating in environmental improvement and protection.
CLO 4: Participation: to provide students with an opportunity to be actively involved at all levels, working towards the resolution of environmental problems.
CLO 5: Skills: to help students to acquires the skills for identifying and solving environmental problems
CLO 6: Evaluation Ability: to evaluate environmental measures and education programs in terms of ecological, economic, social and aesthetic factors.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Articulate the interconnected and interdisciplinary nature of environmental studies; an integrative approach to environmental issues with a focus on sustainability
CO 2: Predict the consequences of human actions on the web of life, global economy and quality of human life, develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development
CO 3: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones
CO 4: Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world, adopt sustainability as a practice in life, society and industry.
Course Content:

Topics	Hours
Unit 1: Multidisciplinary nature of environmental studies, Natural Resources	**8**
Definition, scope and importance need for public awareness. Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.	
Unit II: Ecosystems, Biodiversity and its conservation	**10**
Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of the following ecosystem:- a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) • Introduction – Definition: genetic, species and ecosystem diversity. • Bio geographical classification of India • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values • Biodiversity at global, National and local levels. • India as a mega-diversity nation • Hot-sports of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. • Endangered and endemic species of India • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	

Unit III: Environmental Pollution, Social Issues and the Environment	
Definition, Cause, effects and control measures of:- a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. • Pollution case studies. • Disaster management: floods, earthquake, cyclone and landslides. • From Unsustainable to Sustainable development • Urban problems related to energy • Water conservation, rain water harvesting, watershed management • Resettlement and rehabilitation of people; its problems and concerns. Case Studies • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust Case Studies. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Public awareness.	**10**
Unit IV: Human Population and the Environment, Field work	
Population growth, variation among nations. • Population explosion – Family Welfare Programme. • Environment and human health. • Human Rights. • Value Education. • HIV/AIDS. • Women and Child Welfare. • Role of Information Technology in Environment and human health. • Case Studies. • Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain • Visit to a local polluted site-Urban/Rural/Industrial/Agricultural • Study of common plants, insects, birds. • Study of simple ecosystems-pond, river, hill slopes, etc.	**8**

Suggested Reading:

1. *G. Kiely – Environmental Engineering Irwin/ McGraw Hill International Edition, 1997*
2. *M. L. Davis and S. J. Masen, Principles of Environmental Engineering and Science, McGraw Hill International Edition, 2004*
3. *E. Bharucha, Environmental Studies, University Grants Commission, New Delhi and Bharati Vidyapeeth Institute of Environment and Research, Pune*

JHARKHAND Rai University RANCHI

Program: B.Tech
Semester: Second
Course: Character Building and Holistic Development of Personality 1 (Spiritual & Mental Health)
Course Code: 8VAC101

L	T	P	C
2	0	0	2

Course Learning Objective:

CLO 1: To prepare the student to develop Manomaya Kosha (Development of mind).
CLO 2: To enable the students to develop Vijnanamaya Kosha (Intellectual Development).
CLO 3: To develop an understanding of Anandamaya Kosha **(**Spiritual Development).
CLO 4: To help the students in understanding the virtue of Vasudhaiva-Kutumbakam (the whole world is one family) and also to transform students into ideal personalities by inculcating sanskaaras.

Course Outcome:

On completion of the Course, the students will be able to:
CO 1: Develop a good understanding of Manomaya Kosha.
CO 2: Adapt the concept of constructive roles.
CO3: Analyze the understanding of spiritual development.
CO4: Correlate the importance of world as a family and enable them to develop Manomaya Kosha, Vijnanamaya Kosha, Anandmaya Kosha.

Course Content:

Topics	Hours
Unit I: Cognitive Intellectual Development (Manomaya Kosha)	4
• Character Building : Meaning, Concept, Constituent elements of character and means/ways of character building. • Manomaya Kosha : General Introduction, Meaning and Concept. • Manomaya Kosha : Objectives, Characteristics and Significance. • Benefits of developed Manomaya Kosha and deficiencies due to underdeveloped Manomaya Kosha. • Means, Activities and Programmes to develop Manomaya Kosha.	
Unit II: Cognitive Intellectual Development (Vijnanamaya Kosha)	**4**
• Vijnanamaya Kosha : General Introduction, Meaning and Concept. • Objectives, Characteristics and Significance. • Benefits of developed Vijnanamaya Kosha and deficiencies due to underdeveloped Vijnanamaya Kosha. • Means, Activities and Programmes to develop Vijnanamaya Kosha.	
Unit III: Cognitive Intellectual Development (Anandamaya Kosha)	8
• Anandamaya Kosha : General Introduction, Meaning and Concept. • Objectives, Characteristics and Significance. • Benefits of developed Anandamaya Kosha and deficiencies due to underdeveloped Anandamaya Kosha. • Means, Activities and Programmes to develop Anandamaya Kosha.	
Unit IV: Moral Spiritual Development (To draw inspiration from important events of the lives of great men of India to serve the society and nation).	8
• **Social and National Awakening** : Chanakya, Birsa Munda, Lala Lajpat Rai, Jyotiba Phule, Adi Shankaracharya, Veer Savarkar, • **Women from other countries dedicated to India** : Annie Besant, Emily Shankle Bose, Mary Reed. • **Leading Scientists:** Acharya Sushruta, Acharya Charak, Aryabhatta, Jagdish Chandra Basu, Homi Jahangir Bhabha, A.P.J Abdul Kalam • **Women's Awakening :** Lakshmi Bai, Rani Durgavati, Rani Chenamma, Rani Ahilya Bai Holkar • **Those who sacrificed all:** Bhagat Singh, Khudiram Bose, Chandrashekhar Azad, Mahatma Gandhi. • **Seekers of Self-reliant India**: Vinoba Bhave, Jai Prakash Narayan, Verghese Kurian, M.S.Swaminathan. • **Unique Personality of India** : Dr.Rajendra Prasad, Sardar Ballabh Bhai Patel.	

Suggested Reading:

1. *My Idea of Education, Swami Vivekanand, Advaita Ashram, Kolkata*
2. *Rabindranath Tagore : An Interpretation, Sabyasachi Bhattacharya, Penguin Delhi*
3. *Women Who Created History, NCERT, New Delhi*

JHARKHAND Rai University
RANCHI

SYLLABUS
SEMESTER III

B.TECH
IN
MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Three
Course: Mathematics III
Course Code: 8BSC201

L	T	P	C
3	0	0	3

Course Learning Objective:

- **CLO 1:** To explain the principles of the Fourier and Laplace Transforms and to highlight the domains in which they are used, including PDE applications, digital signal processing, image processing, wave equation theory, differential equations, and many more.
- **CLO 2:** To learn boundary value issues that arise in scientific and engineering difficulties using the Fourier series.
- **CLO 3:** To learn principles of discrete probability to calculate probabilities and expectations of simple random processes.
- **CLO 4:** To learn some discrete structures (e.g., sets, relations, function, graphs) that provide the mathematical formalizations for computational problems.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Evaluate initial value problem and boundary value problem using Laplace Transform.
CO 2: Understand Fourier transform and its properties and will be able to solve the examples based on it. Have deep understanding to handle various types of problems using different kind of integral Transforms.
CO 3: Understand probabilities and discrete distributions for simple combinatorial processes; calculate expectations.
CO 4: Understand set operations, various types of relations and their representations, solving recurrence relations.

Course Content:

Topics	Hours
Unit 1: Laplace Transformation	**10**
Laplace Transformation: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method.	
Unit II: Fourier series and Transform	**6**
Fourier series and Transform: Fourier series, Dirichket's conditions, Determination of Fourier coefficient, Fourier series defined in two or more sub range, half range Series. Fourier Transformation and inverse Fourier Transformation, sine, cosine Transformation, Inverse Transformations -simple illustration.	
Unit III: Sets, Relations and Functions	**8**
Sets, Relations and Functions Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.	
Unit IV: Introduction to Counting Technique and graph	**8**
Introduction to Counting Technique and graph Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions. Introduction to Graphs Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk.	

Suggested Reading:

1. *Higher Engineering Mathematics, B.S. Grewa*
2. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
3. *P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).*
4. *S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.*
5. *J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill*
6. *Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson.*

Program: B.Tech
Semester: Three
Course: Engineering Mechanics
Course Code: 8ESC201

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Use scalar and vector analytical techniques for analysing forces in statically determinate structures
CLO 2: Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
CLO 3: Apply basic knowledge of maths and physics to solve real-world problems
CLO 4: Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
CLO 5: Understand basic dynamics concepts – force, momentum, work and energy;
CLO 6: Understand and be able to apply Newton's laws of motion.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: To understand the basic concepts of force systems & its various force analysis.
CO 2: Understand the static equilibrium of particles and rigid bodies both in two dimensions and three dimensions.
CO 3: Analyze the properties of surfaces & solids in relation to moment of inertia.
CO 4: Illustrate the laws of motion, kinematics of motion and their interrelationship.
CO 5: Understand Kinetics of Rigid Bodies & Free and forced vibrations.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction to Engineering Mechanics - Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space –Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams.	
Unit II:	**6**
Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications.	
Unit III:	**6**
Area moment of inertia: Definition, Moment of inertia of plane sections from first principles, Moment of inertia of standard sections and composite sections, Parallel Axis Theorem, Perpendicular Axis Theorem, Mass Moment of Inertia: Moment of Inertia of Masses – Mass moment of inertia of composite bodies.	
Unit IV:	**6**
Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular).	
Unit V:	**6**
Kinetics of Rigid Bodies : Basic terms, general principles in dynamics; Types of motion, Instantaneous center of rotation in plane motion and simple problems; D' Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies.	

Suggested Reading:

1. *A Textbook of Engineering Mechanics By D S KUMAR*
2. *A Textbook of Engineering Mechanics By R S KHURMI*
3. *A Textbook of Engineering Mechanics By S.S. BHAVIKATTI*
4. *A Textbook of Engineering Mechanics By R.K.BANSAL*

Program: B.Tech
Semester: Three
Course: Elements of Mining Technology
Course Code: 8PCCMiE201

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Enable students to demonstrate the importance of mining in national economy.

CLO 2: Students will understand the terminology associated with the discipline and be familiar with the available regulatory mechanism to enable safe & sustainable mining operations.

CLO 3: Equips the students with detail knowledge on various engineering techniques used for drilling, blasting, roof support and allied activities in mine construction for exploitation of minerals.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Understand the history & significance of mining and mineral resources of India & gain the basic concept of mining, its terminology and classification.

CO 2: Explain the technical knowledge of mode of access to deposit.

CO 3: Underground mine unit operations, its applicability & limitation.

CO 4: Surface mine unit operations, its applicability & limitation.

CO 5: Shaft related terminology & sinking operations**.**

Course Content:

Topics	Hours
Unit 1:	**6**
Mining: Definition and economic importance; Mine – definition, different types and classification; Mine life cycle, Mineral deposit – different types and their classification; Mineral resources of India, Terminology in Mining.	
Unit II:	**8**
Opening-up of Deposits: Choice of mode of entry - adit, shaft, incline, decline and combined mode, their applicability, number and disposition. Box cut- types and location, Vertical/Inclined Shafts, Inclines/Declines: Location, shape, size. Methods of incline/decline drivage.	
Unit III:	**8**
Overview of underground mining: Different coal mining methods and their applicability & limitations; Different metal mining methods and their applicability & limitations; Basic concepts of transportation, ventilation, illumination and support in underground mines.	
Unit IV:	**6**
Overview of surface mining: Types of surface mines, applicability & limitations, unit operations and equipment selection, pit geometry and layout.	
Unit V:	**8**
Shaft sinking: Shaft, shaft collar, Pit Top, Pit Bottom, Staple Pit, Cross measure Drift and shaft inset. Shaft Sinking: Meaning, shaft fittings, Operations- Ground breaking and muck disposal, tools and equipment, lining; ventilation, lighting and watering; Various method of sinking, method of lining; Widening and deepening of shafts.	

Suggested Reading:

1. *Elements of mining technology Vol 1,2, D.J. Deshmukh*
2. *Introductory Mining, H L Hartman*
3. *Principles and Practices of Coal Mining, R D Singh*

Program: B.Tech
Semester: Three
Course: Mining Geology I
Course Code: 8PCCMiE202

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: This will provide basic knowledge on identification of various rocks & minerals by verifying the physical properties.
CLO 2: The course will equip the students with the ability to appreciate the structure of earth and ore formations.
CLO 3: The students will have knowledge about ore reserve estimation, ore assaying, remote sensing, geological mapping and identification of geological structures in the field.
CLO 4: To practice the determination of engineering properties of rocks, preparation of weathering profiles, RMR, RQD, preparation of geological and structural maps and congestion of geological structures in the field.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Enhance the technical knowledge on shape, size, mass & density of earth, age of earth, structure of the earth.
CO 2: Understand the concept of mineralogy with special light on sulphides, silicates and oxides minerals.
CO 3: Explain the process of petrology and formation of rock.
CO 4: Understand the concept of paleontology and stratigraphy & coal and oil belts of India.

Course Content:

Topics	Hours
Unit 1:	**6**
Physical Geology: Origin of Earth, Interior of Earth, Study of Earth surface and features-Mountains/rivers/volcanoes, study and their formation. Types of rocks and their process of formation, types of minerals**.**	
Unit II:	**8**
Mineralogy: Minerals: Physical and chemical properties of crystal, Types of crystallization system, classification of minerals and properties of common silicate minerals (Quartz Feldspar Olivine, Mica), Sulphides (Pyrite, Chalcopyrite Galena Sphalerite) and oxides (Hematite, Magnetite, Chromites, Psilomelane).	
Unit III:	**10**
Petrology: Igneous rocks, Magma and lava extrusive and intrusive forms classification and description of some common igneous rock (Granite Dolerite Gabbros' Basalt)Sedimentary rocks, Sedimentation processes, classification and description of common Sedimentary rocks (Conglomerate Sandstone Shale Limestone).Metamorphic rock Processes of metamorphism, texture and structure of metamorphic rock, classification and description of some common metamorphic rock (Schist Gneiss, Quartzite, Marble)	
Unit IV:	**8**
Paleontology and Stratigraphy: Concept of paleontology, Fossils their mode of preservation and significance as indices of age and climate, concept of index fossils, Principle of stratigraphy, Broad stratigraphy subdivision and associated rock types of important coal belts and oil fields of India.	

Suggested Reading:

1. *A text book of Geology, P.K. Mukherjee*
2. *Structural Geology, S.W. Chiplonkar*

Program: B.Tech
Semester: Three
Course: Mining Geology I Lab
Course Code: 8PCCMiE202P

L	T	P	C
0	0	2	1

List of Experiments:

1. Mineralogy: Study of physical properties of Minerals.
2. To determine the hardness of Minerals
3. Petrology: Study of common igneous rocks.
4. Petrology: Study of common sedimentary rocks.
5. Petrology: Study of common metamorphic rocks

JHARKHAND Rai University RANCHI

Program: B.Tech
Semester: Three
Course: Basic Mine Surveying
Course Code: 8PCCMiE203

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The course provides for basic skills in survey and correct usage of survey instruments.
CLO 2: The student will be able to enter for the Elementary Survey Course.
CLO 3: Appreciate the need for accurate and thorough note taking in field work to serve as a legal record.
CLO 4: Gain the ability to use modern survey equipment to measure angles and distances.
CLO 5: Gain the ability to measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork.
CLO 6: Improve ability to function as a member of a survey party in completing the assigned field work.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Enhance the technical knowledge on linear measurements by chain surveying & tape surveying, compass surveying and plane table surveying.
CO 2: Identify and evaluate the engineering problems in leveling and angular measurements with various surveying tools likes theodolite, levels etc.
CO 3: Apply the use of Total Students & EDM in field and concept of contour.
CO4: Understand the application of plan table survey and modern engineering tools necessary for mine surveying.

Course Content:

Topics	Hours
Unit 1:	**10**
Surveying: Definition, objective, classification and principles of surveying. Linear Measurement: Instruments for measuring distances; ranging and taping survey lines; Chain surveying-principle, field work, off-sets, booking and plotting, obstacles in taping. **Angular Measurement**: Bearing of lines; Rectangular coordinate system; Essentials of the micro-optic theodolite; Measurement of horizontal and vertical angles; Temporary and permanent adjustments; Theodolite traversing; Computation of co-ordinates; Adjustment of traverse; Temporary and permanent adjustments.	
Unit II:	**6**
Levelling: Definition terminology; Levelling instruments types- tilting, auto set and digital levels; Levelling staves; Different types of levelling-differential, profit, cross-sectional and reciprocal leveling; Booking and reduction methods; Underground leveling; Temporary and permanent adjustments of levels.	
Unit III:	**8**
Total Station: Principle of electronic measurement of distance and angles; construction and working with Total Station; Errors; Application and recent developments in Total Station. Contours: Concepts; Characteristics of contour; Contour Interval; Methods of contouring and uses of contours.	
Unit IV:	**8**
Plane Table Surveying: Details surveying and contouring using plane table and micro-optic alidade. Computation of area and volumes.	

Suggested Reading:

1. *Surveying and leveling VOL I,II, T. P. Kanetkar*
2. *Surveying & Levelling , B.C. Punmia*

Program: B.Tech
Semester: Three
Course: Basic Mine Surveying Lab
Course Code: 8PCCMiE203P

L	T	P	C
0	0	2	1

List of Experiments:

1. Locating various objects by chain & determination of area of polygon by Chain Surveying.
2. To find the bearings of various station points and to calculate the included angles in a closed traverse.
3. Study of different parts of a Transit Theodolite and its Temporary adjustments. Measurement of Horizontal angle by method of Repetition and Reiteration method.
4. Study of different Levels and Levelling staffs. Practice of Temporary adjustments and to find out the reduced levels of the given points using Dumpy Level by Height of Collimation method.
5. Calculation of R.L. for different points involving 2 instrument stations & reduction by Rise and fall method.
6. Study of plane table surveying equipment's and accessories. To solve two point and three point problem.

Program: B.Tech
Semester: Three
Course: Effective Technical Communication
Course Code: 8HSMC201

L	T	P	C
3	0	0	3

Course Learning Objective:

The objectives of the course are:
CLO 1: To teach students the principles of technical communication for their academic and professional needs, focusing on essential written and oral skills for presenting technical information effectively.
CLO 2: To make the students aware of the basic principles, which include the analysis of context, purpose and audience.
CLO 3: To enhance fundamentals of technical report writing.
CLO 4: To equip their effective technical presentations.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Be able to grasp the ideas and information put across in a communication situation.
CO 2: To get a proper hold on communication techniques needed in a situation.
CO 3: Have soft skills to work in a team for organizational development.
CO 4: Be able to analyze information and interpret a case study for application.
CO 5: To form simple reports and projects for organizational needs.

Course Content:

Topics	Hours
Unit 1:	**6**
Information Design and Development: Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.	
Unit II:	**8**
Technical Writing, Grammar and Editing: Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	
Unit III:	**6**
Self-Development and Assessment: Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity.	
Unit IV:	**6**
Communication and Technical Writing: Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	
Unit V:	**4**
Ethics: Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.	

Suggested Readings:

1. *David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004*
2. *Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)*
3. *Shiv Khera, You Can Win, Macmillan Books, New York, 2003.*
4. *Raman Sharma, Technical Communications, Oxford Publication, London, 2004.*
5. *Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)*
6. *Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.*

Program: B.Tech
Semester: Three
Course: Community Engagement and Social Responsibility
Course Code: 8UMC102

L	T	P	C
1	0	2	2

Course Learning Objective:

CLO 1: To develop an appreciation of rural culture, life-style and wisdom amongst students.
CLO 2: To learn about the status of various agricultural and rural development programmes.
CLO 3: To understand causes for rural distress and poverty and explore solutions for the same.
CLO 4: To apply classroom knowledge of courses to field realities and thereby improve quality of learning.

Course Outcomes:

On the completion of the Course, the students will be able to:
CO 1: Gain an understanding of rural life, culture and social realities.
CO 2: Develop a sense of empathy and bonds of mutuality with local community.
CO 3: Appreciate significant contributions of local communities to Indian society and economy.
CO 4: Learn to value the local knowledge and wisdom of the community.
CO 5: Identify opportunities for contributing to community's socio-economic improvements.

Course Content:

Topics	Hours
Unit 1: Appreciation of Rural Society	**8**
Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.	
ASSIGNMENT: Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.	
Unit II: Understanding rural economy & livelihood	**8**
Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.	
ASSIGNMENT: Describe your analysis of rural h o u s e h o l d economy, its challenges and possible pathways to address them.	
Unit III: Rural Institutions	**8**
Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration.	
ASSIGNMENT: How effectively are Panchayati raj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio- visual)	
Unit IV: Rural Development Programmes	**8**
History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.	
ASSIGNMENT: Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community; give suggestions about improving Implementation of the programme for the rural poor.	

Suggested Reading:

1. *Singh, Katar, Rural Development : Principles, Policies and Management, Sage*
2. *Publications, New Delhi, 2015.*
3. *A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati*
4. *Raj Studies, 2002.*
5. *United Nations, Sustainable Development Goals, 2015 un.org/sdgs/*
6. *M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers, 2016.*

JHARKHAND Rai University RANCHI

SYLLABUS
SEMESTER IV

B.TECH
IN
MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Four
Course: Thermodynamics & Fluid Mechanics
Course Code: 8ESC202

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Ability to apply mathematics, science, and engineering

CLO 2: Ability to design and conduct experiments, as well as to analyze and interpret data

CLO 3: Ability to identify, formulate, and solve engineering problems

CLO 4: Ability to apply modern engineering tools, techniques and resources to solve complexmechanical engineering activities with an understanding of the limitations.

CLO 5: Ability to comprehend the thermodynamics and their corresponding processes thatinfluence the behavior and response of structural components

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Understand the basic thermodynamics systems & concept of temperature and heat.

CO 2: To identify and formulate power production based on the fundamentals laws of thermal engineering.

CO 3: Understand the various cycles and its implications in real practical applications.

CO 4: To appreciate concepts learnt in fundamentals laws of thermodynamics from whichlearning ideas how to sustain in energy crisis and think beyond curriculum in the field ofalternative and renewable sources of energy. To communicate effectively the concepts of internal combustion engines and try to think beyond curriculum in alternative sources of energy.

CO 5: Understand and apply the principles of fluid mechanics, including types of fluid flow, pressure concepts, flow measurement devices, and pipe flow analysis, to solve basic engineering problems.

Course Content:

Topics	Hours
Unit 1:	**4**
Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of Thermodynamics, concept of temperature and heat. Concept of ideal and real gases.	
Unit II:	**6**
First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat, Enthalpy, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow.	
Unit III:	**8**
Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. perpetual-motion machines, reversible and irreversible processes, Rankine cycle and the ideal reheat and regenerative.	
Unit IV:	**8**
Properties of fluid- Introduction, types of fluid, fluid mechanics, classification of fluid mechanics. Properties of fluid- Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Compressibility.	
Unit V:	**10**
Fluid Flow - Types of fluid flows, Capillarity, Vapor Pressure, Fluid pressure, Pressure head, Pressure intensity, buoyancy, atmospheric pressure, absolute pressure, total pressure. Continuity equation Bernoulli's theorem, Venture meter–Construction, principle of working, Coefficient of discharge, Orifice meter– Construction, Principle of working, Pitot tube–Construction, Principle of Working. **Flow Through Pipes**- Laws of fluid friction (Lamina rand turbulent), Darcy's equation and Chezy's equation for frictional losses. Minor losses in pipes.	

Suggested Reading:

1. *Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.*
2. *Cengel, Thermodynamics – An Engineering Approach Tata McGraw Hill, New Delhi.*
3. *Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.*
4. *Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of*
5. *Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.*
6.

JHARKHAND Rai University RANCHI

Program: B.Tech
Semester: Four
Course: Elements of Rock Mechanics
Course Code: 8PCCMiE204

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The course provides detailed knowledge on rock properties
CLO 2: This will equip the students with the ability to carry out various tests and monitoring the rock behavior.
CLO 3: Students will be able in analysis of analysis of data and solving rock mechanics problem in mining and excavation projects.
CLO 4: Provides detailed knowledge on rock properties and equips the students with the ability to carry out various tests.
CLO 5: Students will be able in analyzing the data and solving rock mechanics problem in mining and excavation projects.
CLO 6: Data and solving rock mechanics problem in mining and excavation projects.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand the basic knowledge of rock mechanics for understanding, formulating and solving strata control problem in any underground mine.
CO2: Explain the various physico mechanical properties of rock in respect to mining.
CO3: Acquire knowledge and hands-on competence in applying the concepts of rock failure theories.
CO4: Evaluate the dynamic properties of rock, creep theory and rock mass by various Laboratory test & in situ test

Course Content:

Topics	Hours
Unit 1:	**8**
Rock mechanics: Definition, history, source of information and field of application of rock mechanics. Basic concept of stress, strain and failure of rock , Analysis of stress, Analysis of strain, Parameters influencing strength/stress-strain behavior .	
Unit II:	**6**
Physico-mechanical properties of rock: Determination of physical properties, strengths, strength indices and static elastic constants; Parameters influencing strength and its determination.	
Unit III:	**8**
Failure Criteria for Rock and Rock Mass Classical theories of rock failure: Coulomb's criterion, Mohr's criterion, Pre-mining state of Stress Stresses in rock mass, Factors influencing the in situ state of stress, Estimating in situ stresses;	
Unit IV:	**10**
Dynamic properties of rock and rock mass: Propagation of elastic wave in rock media; Determination of dynamic strength and elastic constants of rock. Time dependent properties of rock: Creep deformation and strength behavior; Creep test and rheological models. In situ shear tests; Evaluation of shear strength; In situ bearing strength test; In situ deformability tests-Plate Loading Test, Plate Jacking Test and Bore hole Jack Tests.	

Suggested Reading:

1. *Elements of Mining Technology Vol I, D.J. Deshmukh*
2. *The elements of mechanics of mining ground, B.S. Verma*
3. *Rock Mechanics for Engineers, Dr. B.P. Verma*

Program: B.Tech
Semester: Four
Course: Elements of Rock Mechanics Lab
Course Code: 8PCCMiE204P

L	T	P	C
0	0	2	1

List of Experiments:

1. Preparation of rock sample for testing in laboratory.
2. Determination of compressive strength of rock.
3. Determination of tensile strength of rock.
4. Determination of triaxial strength of rock.
5. Determination of shear strength of rock
6. Determination of Point load Strength Index of rock
7. Determination of modulus of elasticity and Poisson's ratio of rock.

Program: B.Tech
Semester: Four
Course: Mining Geology II
Course Code: 8PCCMiE205

L	T	P	C
3	0	0	3

Course Learning Objective:

The objective of this course is to help the students

CLO 1: To develop knowledge on economics of ore, exploration and practical site investigation.
CLO 2: To create knowledge about geology of rock, geological disturbances and identification of geological structures in the field.
CLO 3: To know the coal geology and complete geology of petroleum from origin to extraction.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Discuss the structural geology in aspects of engineering requirements & structural disturbances.
CO 2: Apply the knowledge gained in the contexts of exploration and mineral distribution and able to design the stages of exploration of economic minerals.
CO 3: Discuss the geology of coal along with its classification and origin of coal.
CO 4: Describe the concept on petroleum geology with its migration, accumulation & important basins of India.

Course Content:

Topics	Hours
Unit 1:	**10**
Structural Geology: Study of topographical maps; Altitude of planar and linear structures; Effects of topography on outcrops. Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Forms of igneous intrusions - dyke, sill and Batholith. Effects of folds and fractures on strata/ore bodies and their importance in mining operations.	
Unit II:	**10**
Economic Geology and Exploration Geology: Introduction and scope of economic geology; Ore and gangue; Processes of ore formation; Major Indian mineral deposits (Iron, Manganese, Copper, Lead, Zinc) - distribution and mode of occurrence. Mineral Exploration – concepts and methods viz. surface and subsurface; Stages of exploration; Resources and reserves.	
Unit III:	**8**
Coal Geology : Rank, characteristics and important constituents of coal; Classification and origin of coal; Chief characteristics of Indian coals; Geology of the principal coalfields of India.	
Unit IV:	**8**
Petroleum Geology : Concept of organic constituents of petroleum origin, migration, accumulation, concept of traps and important petroliferous basins of India.	

Suggested Reading:

1. *A text book of Geology, P.K. Mukherjee*
2. *Physical Geology, A.K. Dutta*

Program: B.Tech
Semester: Four
Course: Mining Geology II Lab
Course Code: 8PCCMiE205P

L	T	P	C
0	0	2	1

List of Experiments:

1. Study of Geology maps.
2. Study of Contour maps.
3. Maps illustrating fold, fault and unconformity.
4. Demonstration of igneous intrusions: Dykes, Sills, & Batholiths
5. Demonstration of streaks in different mineral

Program: B.Tech
Semester: Four
Course: Surface Mining
Course Code: 8PCCMiE206

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Enables the students to apply the knowledge of mining machinery in their economic deployment for achieving the production targets in opencast mines.
CLO 2: The students will have insight about the advanced techniques for mine planning, geotechnical investigation and equipment management and also will understand the modern trends in opencast mines, safety and environment.
CLO 3: The students will have ability to classify and select the suitable surface mining methods and equipment based on site conditions. They will also have a concept of waste dump formations and slope failures in surface mines.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand the basic concept of surface mining for understandingthe applicability &slope stability problem in any opencast mine.
CO2: Understand the application and operation of shovel, dragline,dozer and other opencast machinery.
CO3: Understand the application, operation and limitation of bucket wheel excavator and surface transport system.
CO4: Explain the applicability of the different in-pit crushing and conveying methods& interpretation of slope stability.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction: Surface mining-basic concepts, applicability, advantages and disadvantages; Role of surface mining in total mineral production; Surface mining unit operations; Surface mining equipment systems– classification, applicability, advantages and disadvantages. Opening up of deposits: Boxcut – objective, types, parameters, methods; Factors affecting selection of box cut site; Production benches– formation, parameters and factors affecting their selection.	
Unit II:	**10**
Discontinuous/cyclic methods of excavation and transport: Shovel: Applicability and limitations of shovel, Cycle time and productivity calculation for shovel; Dragline operation: Applicability and limitations, different modes of operation; Cycle time and productivity calculation; Maximum usefulness factor and its significance in selection of dragline for a given situation; Scrapers: Applicability and limitations, various types; Method and cycle of operation; Dozers: Applicability and limitations; Types and classification; merits and demerits; Method and cycle of operation. Front-end- loaders: Applicability and limitations.	
Unit III:	**8**
Continuous methods of excavation and transport: Bucket wheel excavators: Applicability and limitations; Types and principle of operation; Calculation of productivity. Continuous surface miners: Types, classification, applicability and limitations; Principles of operation; Conveyors: types of conveyors; Mode of operation, applicability and limitations; Merits and demerits of conveyor as a system of transportation. Different in-pit crushing and conveying methods and their respective applicability &limitations,	
Unit IV:	**6**
Slope: Types of mine slope–high wall and waste dumps; Common modes of slope failure; Factors influencing stability of slopes; Slope stability assessment techniques.	

Suggested Reading:

1. *Explosive and Blasting Techniques, G.K. Pradhan*
2. *Explosives and Blasting Techniques, S.K. Das*
3. *Surface Mining, G.B. Mishra*

Program: B.Tech
Semester: Four
Course: Mine Surveying & Geospatial Technology
Course Code: 8PCCMiE207

L	T	P	C
3	0	0	3

Course Learning Objective:

The objective of this course is to help the students

CLO 1: To understand & carry out underground surveys and stope measuring.
CLO 2: To develop plotting contour plans
CLO 3: Understand advanced surveying techniques such as remote sensing and geodetic surveying.
CLO 4: The students will have practical knowledge about recent development of surveying and mine planning.
CLO 5: Students are made aware about the modern survey equipment and methods for precision survey.
CLO 6: The students will have practical knowledge about survey instruments and its workings.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Illustrate & apply various survey instruments like Total Station, Theodolite, EDM used in general and mine survey, through practical and demonstrations.
CO 2: Apply knowledge of surveying for understanding, formulating and solving correlation surveying problems & slope surveying.
CO 3: Demonstrate GPS used in general mine survey in opencast mine.
CO 4: Analyze the application of IT in surveying & GIS.

Course Content:

Topics	Hours
Unit 1:	**8**
Control Surveys: Triangulation–classification of triangulation system, triangulation figures, reconnaissance, selection of station, observation of horizontal angles, base line extension, concept of satellite station, Base line measurement: different types of application of triangulation survey.	
Unit II:	**8**
Correlation Survey : Meaning, Purpose, Methods of correlation–direct traversing in inclined shaft, correlation in vertical shaft–single and two shaft. **Contouring**: Concepts, Characteristics, Contour Interval, Methods of contouring and uses of contours.	
Unit III:	**10**
Introduction to Geospatial Techniques and tools: concepts of Geodesy, Photogrammetry, Remote Sensing and GIS. **Remote Sensing**: Introduction to remote sensing, sensors, platforms and their characteristics, Application of Remote Sensing. **GIS:** Introduction to GIS, components, application of GIS, spatial data models – Raster and Vector data. Data Management and Analysis; Advantages and disadvantages of Raster or Vector Data ; Uses of GIS.	
Unit IV:	**6**
GPS: Principle of GPS; Instrument; Errors and working with GPS; Application of GPS in mine surveying; Developments in satellite based Navigation system. **Photogrammetry** – Meaning, Classifications of Photogrammetry, Vertical and oblique photographs, height determination, photographic interpretations, Aerial photography- Basics of aerial photography.	

Suggested Reading:

1. *Surveying and leveling , T. P. Kanetkar*
2. *Surveying & Levelling , B.C. Punmia*

Program: B.Tech
Semester: Four
Course: Mine Surveying & Geospatial Technology Lab
Course Code: 8PCCMiE207P

L	T	P	C
0	0	2	1

List of Experiments:

1. To determine the height of an object by Trigonometric Leveling when base is inaccessible.
2. To determine the height of an object by Trigonometric Leveling when base is accessible.
3. To draw a contour map by square or grid system.
4. Determination of area of a closed traverse using total station.

Program: B.Tech
Semester: Four
Course: Drilling & Blasting Technology
Course Code: 8PCCMiE208

L	T	P	C
3	0	0	3

Course Learning Objective:

The objective of this course is to help the students

CLO 1: To develop knowledge on drilling and blasting operations in underground and surface mines.
CLO 2: To design blasting pattern for mines and blast design in surface and underground mines.
CLO 3: To develop knowledge about exploration techniques, drilling operations, casing, various explosives used in opencast & underground.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Understand the exploration techniques, drilling operations, casing, coring and data interpretation.
CO 2: Analyze the appropriate application of explosive in opencast & underground mines.
CO 3: Explain blasting engineering for understanding, formulating and solving blast hole design problems in surface mining and various techniques and their applicability in underground mines.
CO 4:. Ability to design the surface blast round and predict the outcomes of the blast design.

Course Content:

Topics	Hours
Unit 1:	**8**
Exploratory Drilling : Drilling for exploration; Various types of exploratory drills and their applicability- Auger, Cable-tool, Odex, Core Drills; Core recovery; single and double tube core barrels, wire line core barrel.	
Unit II:	**8**
Drilling & Blasting in Surface Mines: Blast hole drills –types, classification, applicability and limitations; **Drilling & Blasting in Underground Mines**: Coalmines: Drilling systems and their applicability, blasting-off-solid, different blasting cuts, calculation of specific charge, specific drilling and detonator factor, initiation patterns.	
Unit III:	**10**
Explosives and Initiation systems **: Types of explosives, their composition and properties, classification; Selection of explosives; Manufacture, transport, storage and handling of explosive; Testing of explosives.** **Initiating systems**- Electric, Non electric initiating system, Electrical Detonators & Non electrical Detonator, Detonator fuse, Detonator Relays, NONEL, Electronic Detonators, Blasting accessories, exploders. Safety in usages and handling of explosives & initiating systems.	
Unit IV:	**10**
Mechanics: Mechanics of drilling**,** performance parameters, drilling cost, compressed air requirement for hole cleaning; Mechanics of rock fragmentation; Living stone theory of crater formation; Factors affecting blasting, Blast design – estimation of burden and spacing, estimation of charge requirement; evaluation of drill performance; drill ability of rocks; mechanism of bit wear; bit selection; problems of drilling. **Controlled blasting Techniques:** Advanced theory and application of explosives in excavation, damage and special blasting techniques used in Controlled blasting.	

Suggested Reading:

1. *Explosive and Blasting Techniques, G.K. Pradhan*
2. *Explosives and Blasting Techniques, S.K. Das*
3. *Elements of Mining Technology Vol 1 , D J Deshmukh*
4. *Underground Practices, R D Singh*

Program: B.Tech
Semester: Four
Course: Character Building and Holistic Development of Personality 2 (Yoga and Physical Fitness)
Course Code: 8VAC201

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: To generate awareness among students about health and yoga.

CLO 2: To encourage students to be environmentally conscious, conserve water and practise good hygiene.

CLO 3: To acquaint the students with the fundamental principles of national unity and integration through practicing yoga.

CLO 4: To develop Annamaya Kosha (Physical Development) and Pranamaya Kosha (Development of Prana).

Course Outcome:

On completion of the Course, the students will be able to:

CO 1: Develop a good understanding of spiritual and mental health.

CO 2: Adapt the concept of sustainability and development.

CO3: Understand the importance of Yoga and practice it in day to day life.

CO4: Enable to develop Annamaya Kosha and Pranamaya Kosha.

Course Content:

Topics	Hours
Unit I: Physical Vital Development	4
• Health: Meaning, Concept, Dimensions of health (mental, physical, social and spiritual) and health related general habits. • Ideal daily routine/ Lifestyle : Meaning, Concept, Principles and its related practice • Balanced Diet : Meaning, Concept, Benefits, Alkali and Acid, Balanced Diet according to Desh (location), Kaal (time), Ayu (age) and Ritu (season) • Ritucharya (Seasonal Habits) : Meaning, general Introduction, Concept, Month and Festivities according to season, Nature of Earth, Lifestyle according to Shishir Season. • Sukshama Vyayama and Surya Namaskara : General Introduction, Precautions and Practice.	
Unit II: Yoga and its Importance	**4**
• Yoga: Meaning, Concept, Aims and Objectives, Types. • Diet and Health : Conditions, Malnutrition (Undernutrition and Over Nutrition) causes, Problems and Solutions, Common points of consideration for nutrition. • Vasant Ritucharya: Lifestyle according to Spring season; Lifestyle- General Introduction, Concept, Month and Festivities according to season. • Pranayama: General Introduction (Bandh, Nadi and Chakra), Importance, Eligibility, Time, Place, position, Principles of Practice and Precautions • Asana: General Introduction, Types, Benefits, Precaution and Practice (Asanas in Standing position) • Practice of Sukshama Vyayama and Surya Namaskara	
Unit III: Yoga and Physical Fitness	8
• Ashtanga Yoga: General Introduction, Parts, Meaning of Yama and Niyama, Concept, aims and Objectives. • Diet and Health: Nutrients of Food -Carbohydrates, Proteins and Fats – Structure/Elements, Requirement/Utility & Sources • Grisham Ritucharya: Lifestyle according to summer season- General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Pranayama: Importance, Rules, Precautions and Practice of Inhalation (Purak) Exhalation (Rechak) and Holding of Breath • Asanas: (Bending Asanas)- General Introduction, Benefits, Precautions and practice of Padhastasana, Utkataana, Garudasana, Tulasana and Ardg-Chandrasana • Practice of Sukshama Vyayama and Surya Namaskara • Varsha Ritucharya: Lifestyle according to rainy season- General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Diet and Health: Nutrients of Food – Vitamins, Mineral and Water structures/elements, Requirement & Sources. • Pranayama: Importance, Rules, Precautions and Practice of Anuloma-Viloma, Bhramari and Kapalbhati Pranayama • Asanas: (In Sitting Position) - General Introduction, Benefits, Precautions and practice . • Practice of Sukshama Vyayama and Surya Namaskara	

Unit IV: Practices of Yoga	
• Sharad Ritucharya: Lifestyle according to Autumn season- General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Pranayama: Importance, Rules, Precautions and Practice of Chandrabhedi, Suryabhedi and Ujjai Pranayama. • Asanas: (asanas performed in Supine position) - General Introduction, Benefits, Precautions and practice. • Practice of Sukshama Vyayama and Surya Namaskara. • Hemant Ritucharya: According to Hemant season- Meaning, General Introduction, Concept, Month and Festivities according to season, Nature of the Earth. • Pranayama: Importance, Rules, Precautions and Practices of Sheetali, Sheetkari and Nadi Shodhan Pranayama. • Asanas: (asanas performed in Prone position) - General Introduction, Benefits, Precautions and practice . • Practice of Sukshama Vyayama and Surya Namaskara • Self Defense: Meaning, Purpose, Required Capabilities; • Relaxation: Shoulder-movement exercise for Spine & maintaining the balance • Marmasthala – Common Vulnerable/Vital Points • Prahara : Meaning, Striking Organs, Types of Strikes, Precautions. • Preventing possible strikes, Preventing Organs and types/uses	8

Suggested Reading:

- *Yoga for Everyone, B.K.S.Iyengar, Dorling Kindersley Ltd; New Delhi*
- *Yoga the Path to Holistic Health, .B.K.S.Iyengar, Dorling Kindersley Ltd; New Delhi*
- *Science of Yoga, Ann Swanson, Dorling Kindersley Ltd; New Delhi*

JHARKHAND Rai University
RANCHI

SYLLABUS
SEMESTER V

B.TECH
IN
MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Five
Course: Mining Machinery I
Course Code: 8PCCMiE301

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Enables the students to select appropriate machinery for various mining operations based on the production targets.
CLO 2: The students will have knowledge on function of winding engines, winding accessories, pit-top and bottom mine circuits.
CLO 3: They will also know about working of various coal face machinery, face haulage systems and conveyors.
CLO 4: The students will have basic knowledge on motive power used in mines, rope haulage and other transport systems.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand the classification & application of mine machinery.
CO2: Understand the winding system and safety features.
CO3: Able to apply the knowledge of power transmission system and installation in mines.
CO4: Explain the types, selection and uses of mining ropes and able to apply the knowledge of rope capping and splicing.

Course Content:

Topics	Hours
Unit 1:	**8**
Wire Ropes Types- classification, lays**,** construction, test of wire rope and uses. Rope deterioration and maintenance. Capping and splicing of rope.	
Unit II:	**6**
Winding: Classification and constructional difference of different types of winders, mechanics of winding, power calculation, rope selection, inspection, and maintenance. Safety features and contrivances. Winding Drum and friction winding, headgears, headgear pulleys, cages and skips, suspension gear, keps and guides.	
Unit III:	**10**
Transmission of Power: Belt, rope, chain, gear, hydraulic and electro-hydraulic transmission. Compressed Air Comparison with other sources of power. Air compressors – types, construction, installation and maintenance. **Pump:** Classification, construction, and selection steps for mine dewatering pumps.	
Unit IV:	**8**
Rope haulages: Classification of haulage system, applicability, advantages & disadvantages, Track, mine tubs and cars. Safety appliances on haulage roads. Locomotive haulage. Mono rail. Statutory Provisions.	

Suggested Reading:

1. *D.J. Deshmukh VOL III*
2. *Mine pump, haulage, winding. S. GHATAK*

Program: B.Tech
Semester: Five
Course: Mine and Mineral Economics
Course Code: 8PCCMiE302

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The course enables the students to understand the economics of business enterprise to become a successful manager.
CLO 2: Students gain knowledge on the basic management principles to become management(s) professional.
CLO 3: Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.
CLO 4: Expertise the students to brings employment, government revenues, and opportunities for economic growth and diversification through mining.
CLO 5: Study of estimation and valuation of mineral deposit and study of project appraisal.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Apply knowledge of mine economics for understanding mineral related policies and solve problems related with the mine economics.
CO 2: Analyze and solve the concepts of mine economics, its risk and mineral inventory.
CO 3: Describe the concept of mine sampling & illustrate the valuation of mineral deposit and be able to estimate the mine life and profitability.
CO 4: Discuss the forms of business, royalty, taxes & duties in mining sector.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction: Economic importance of the mineral industry; mining economy, risky nature of the mining industry, Demand and Supply, national mineral policy. Mineral price and pricing: International monetary system, Factors affecting mineral price, kinds of price quotation, Mineral price index, Mineral prices.	
Unit II:	**10**
Evaluation of Mineral Deposits: Mineral resource concept, classification and estimation of ore reserves. **Mine sampling**: Mine sampling: Definition, purpose and scope, methods: groove/channel sampling; Chip sampling; grab sampling; Bulk sampling; Conservation of mineral resources and Loss of mineral in mining: Means of conservation and limitations in the scope of Conservation. Classification and incorporation of losses; coefficient of completeness of mineral extraction; dilution and recovery.	
Unit III:	**8**
Cost of mining: Capital and operating costs; Factors affecting operating cost; Methods of estimating future costs; standard cost and forecast. Mine valuation: Basic concept, Earlier approaches to mine valuation, recent approaches to valuation; Time value of money, Price information – revenue estimates, annuity, Accounting profits and cash flows. **Investment Appraisal**: Elements of investment appraisal, Static methods of investment appraisal, Dynamic methods of appraisal, discounted cash flow analysis.	
Unit IV:	**8**
Mine Valuation, Project financial indicators; Consumer Price Index, Effects and Inflation, Depreciation and Amortization; Introduction to Mining finance, non-banking mine finance and stock operation; Quantification and management of mining investment risk. Discounted cash flow concept, Net Present Value and Internal Rate of Return (IRR), Determining appropriate discount rate.	

Suggested Reading:

1. *Gentry D.W., O'Neil T.J. (1984). Mine Investment Analysis. Society for Mining Metallurgy & Exploration, Englewood, CO (USA).*
2. *Ray S. C., Sinha I. N. (2016). Mine and Mineral Economics, PHI Learning.*
3. *Runge I. C. (1998). Mining Economics and strategy. Society for Mining Metallurgy & Exploration, Englewood, CO (USA).*
4. *Michael S. (2019). Mining Capital, Springer Nature, Switzerland AG.*
5. *Marian R., Wårell L. (2021). A Handbook of Primary Commodities In The Global Economy, Cambridge University Press.*
6. *Prasanna C. (2019). Financial Management: Theory and Practice (10 Edition), McGraw Hill Education (India).*

Program: B.Tech
Semester: Five
Course: Underground Coal Mining
Course Code: 8PCCMiE303

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The students will have good exposure about the various advanced methods of coal mining with the knowledge about advanced coal face mechanization.
CLO 2: To pioneer the history of longwall mining and its development stages.
CLO 3: To understand the extraction, support and transport on a longwall face.
CLO 4: Enables the students to appreciate various coal mining methods and to ably manage highly mechanized mines.
CLO 5: To introduce the recent trends of level of mechanization for coal face.
CLO 6: To understand the various advanced methods of coal mining.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Explain the technical knowledge on development &extraction of coal by board & pillar mining.
CO2: Understand the method &problems of extraction of coal from the underground mines along with stowing.
CO3: Explain the basic knowledge of long wall mining with its applicability, components and machinery required for mining.
CO4: Apply the knowledge of various support system in mineswith its advantages & applicability.

Course Content:

Topics	Hours
Unit 1:	**10**
Bord and Pillar Mining: Introduction: History of coal mining; coal resource; Choice of methods of mining coal seams; factors affecting choice of mining methods. General principles of Bord and Pillar (B&P) development and associated merits/demerits; Design of B&P workings, statutory provisions related to B&P workings, Semi- mechanized and mechanized schemes of B&P development; Mechanized face loading. Conditions suitable for mechanical loaders and continuous miners.	
Unit II:	**8**
Pillar Extraction: Preparatory arrangement for depillaring operation, statutory provisions on depillaring; principles of designing pillar extraction, factors affecting choice of pillar extraction; partial and full extraction; depillaring with caving and stowing; mechanization in depillaring operation.	
Unit III:	**8**
Long wall Mining: Factors affecting long wall mining, long wall face layouts, advancing and retreating faces, single versus double unit long wall faces, orientation of longwall faces; single versus multiple heading gate roads, factors affecting length and width of long wall panel. Extraction of Long wall panel, working with shearer and plough, support system of long wall face and gate roads, case studies of long wall faces in India.	
Unit IV:	**6**
Roof Supports: Timber props and cogs; powered supports; Wire mesh, steel lining,; improvised steel props, friction props, hydraulic props; link bars and chocks, powered supports; Cement support:, concrete blocks, concrete slabs, guniting and shotcreting. **Rock support**: Pillars of ore and waste, packwalls, masonry walls and arches building materials and construction, Roof bolting Supports and principle, types of roof bolts; function, applicability and advantage of roof bolting and cable bolting; Local and main fall, indications of roof weighting, measures to bring down roof at regular interval; air blast and measures to minimize its effects.	

Suggested Reading:

1. *Underground Winning of Coal, T.N.Singh*
2. *Modern Coal Mining Technology, S.K. Das*
3. *Elements of Mining Technology Vol I, D.J. Deshmukh*

Program: B.Tech
Semester: Five
Course: Operational Research in Mining
Course Code: 8PCCMiE304

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The students will learn the concept of system engineering and applicability in mining field.
CLO 2: The students should have awareness about optimization and utilization of resources & apply operations research technique like Simplex, two phases, Big M in managerial operations.
CLO 3: The students should have facility with mathematical & computational modelling of real decision making problems, including the use of modelling tool and computational tools as well as analytic skill to evaluate the problems based on Assignment and Transportation.
CLO 4: To study the various techniques of operations research, simulation and network analysis.
CLO 5: Enables the students to know basic of system engineering concept and analysis.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method.
CO 2: Formulate specialized linear programming problems, namely transportation and assignment problems and describe theoretical workings of the solution methods for transportation and assignment problems.
CO 3: To develop the abilities in project evaluation techniques like PERT, CPM etc.
CO 4: Apply the knowledge of game theory concepts to articulate real-world decision situations for identifying, analyzing, and practicing strategic decisions to counter the consequences.

Course Content:

Topics	Hours
Unit 1:	**8**
Linear Programming :Linear Programming models; Assumption of linear programming, Graphical and Simple method of solving Linear Programming Problems; Basic and Basic feasible solution, optimal solution, interpretation of SIMPLEX table. Primal and Dual Problem. Application of Linear Programming for solution of mining related problems of production planning, scheduling and blending.	
Unit II:	**8**
Transportation and Assignment Problem: Transportation models, Solution. Algorithm for Transportation problem. Assignment model, Variations on Classical Assignment model; solution algorithm for Assignment problems. Mathematical formulation of an assignment problems. Difference between transportation and assignment problems.	
Unit III:	**8**
Project Management with PERT &CPM: Assumption of PERT and CPM; Methods of drawing network; Rules of network construction, numbering the events, construction of network, Time analysis ; Forward pass computation; backward pass computation; determination of floats and slack times; Critical path calculation.	
Unit IV:	**6**
Game Theory: Definition; pay off, types of games, the Maximin- Minimax principle, games without saddle point, graphical method, dominance property.	

Suggested Reading:

1. *Numerical Methods in Engineering and Science" by Grewal B.S. and Grewal J.S*
2. *Optimization: Linear Programming by B K Mishra and B N Mishra*
3. Linear Programming: Foundations and Extensions by Robert J Vanderbei

Program: B.Tech
Semester: Five
Course: Ventilation & Climate Control
Course Code: 8PCCMiE305

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Course Objective:

CLO 1: Enables the students to understand the airflow in sufficient quantity and quality to dilute contaminants to safe concentrations in all parts of the facility where personnel are required to work or travel.
CLO 2: Enables the students to understand the ventilation requirements.
CLO 3: Students will be able in selecting appropriate mine fans and design suitable ventilation structures.
CLO 4: The students will have deep knowledge about the mine accidents, disaster, disease and mine safety with risk assessment, mitigation and management.
CLO 5: To learn ventilation methods and strata monitoring instruments.

Course Outcome:
On the completion of the Course, the students will be able to:
CO 1: Classify mine gases & summaries various ventilation instruments.
CO 2: Illustrate the technical knowledge on origin, occurrence, effects, and detection of various mine gases, air conditioning of surface and underground mining.
CO 3: Explain & differentiate between natural ventilation & mechanical ventilation.
CO 4: Design ventilation plan & layout considering various parameters.

Course Content:

Topics	Hours
Unit 1:	**8**
Composition of mine atmosphere: Mine gases production, properties and effects; Sampling and analysis of mine air; Methane content; Methane drainage; Flame safety lamp and its uses; Methanometer; Methane layering; Radon gas and its daughter products; Monitoring of gases.	
Unit II:	**8**
Heat and humidity: Sources of heat in mines; Effects of heat and humidity; Psychrometry, Kata thermometer; Air-conditioning. **Air flow through mine openings:** Laws of flow, resistance of airways, equivalent orifice, losses in airways, distribution of air, economic design of airways; Flow control devices; Permissible air velocities in different types of workings/openings; Standards of ventilation.	
Unit III:	**10**
Natural ventilation: Causes, effect of seasonal variations, calculation of NVP from air densities, thermodynamic principles and other methods. Mechanical ventilation: Types of mine fans; Theory, characteristics and suitability of fans; Selection, testing and output control; Fans in series and parallel; Forcing and exhaust configurations; Reversal of flow; Fan drifts, diffusers, evasee; Booster and auxiliary ventilation; Venturi blowers; Ventilation of deep mines	
Unit IV:	**6**
Ventilation planning: Planning of ventilation systems and economic considerations; Ventilation layouts for mining of coal and ore deposits; Ventilation of workings/stopes using heavy blasting; Calculation of air quantity required for ventilating a mine; Calculation of total mine head; Network analysis principles and computer applications;; Ventilation surveys.	

Suggested Reading:

1. *Elements of Mining Technology Vol, II, D.J. Deshmukh, Central techno publication, Nagpur*
2. *Mine Environment Ventilation, G.B. Misra, Oxford University Press, Calcutta*
3. *Mine Disaster & Mine Rescue, M.A. Ramlu, Oxford University Press, Calcutta*

Program: B.Tech
Semester: Five
Course: Ventilation & Climate Control Lab
Course Code: 8PCCMiE305P

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List of Experiments:

1. Demonstration of Flame safety lamp–construction and gas testing.
2. Detection of carbon monoxide using detector tube.
3. Estimation of air cooling power using Kata thermometer.
4. Demonstration of vane Anemometer and determination of quantity by Anemometer.
5. Demonstration of velometer and measurement of air velocity by velometer.
6. Study and use of Methanometer.

OPEN ELECTIVE COURSE I (Any one of the following subjects)

Program: B.Tech
Semester: Five
Course: Indian Knowledge System (IKS)- Concepts and Applications in Engineering
Course Code: 8OEC301

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Course Learning Objective:

CLO 1: The basic object of the course is to provide the acquaintance with the basic features of Indian Constitution e.g. Fundamental Rights, Fundamental Duties and Directive Principles of State policy.
CLO 2: To impart the knowledge about Judicial system in India.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand the basic features of our constitution.
CO2: Learn the concept of Right to Equality & Prohibition on grounds of Religion, Race, Caste, sex &Place of Birth.
CO3: Understand the concept of Basic freedoms, Protection in respect of conviction for offences &Right to Life and Personal Liberty.
CO4: Explain the Right against exploitation &Freedom of Religion.
CO5: Understand the concept of Directive Principles of State Policy and their relation with Fundamental Rights, Fundamental Duties &Right to Property.

Course Content:

Topics	Hours
Unit 1: Indian Knowledge System – An Introduction:	
1. What is IKS? 2. Why do we need IKS? 3. Organization of IKS 4. Historicity of IKS 5. Some salient aspects of IKS	**3**
Unit II: The Vedic Corpus:	
1. Introduction to Vedas 2. A synopsis of the four Vedas 3. Sub-classification of Vedas 4. Messages in Vedas 5. Introduction to Vedāṅgas 6. Prologue on Śikṣā and Vyākaraṇa 7. Basics of Nirukta and Chandas 8. Introduction to Kalpa and Jyotiṣa 9. Vedic Life: A Distinctive Features	**4**
Unit III: Number Systems and Units of Measurement:	
1. Number systems in India - Historical evidence 2. Salient aspects of Indian Mathematics 3. Bhūta-Saṃkhyā system 4. Kaṭapayādi system 5. Measurements for time, distance, and weight 6. Piṅgala and the Binary system	**4**
Unit IV: Mathematics:	
1. Introduction to Indian Mathematics 2. Unique aspects of Indian Mathematics 3. Indian Mathematicians and their Contributions 4. Algebra 5. Geometry 6. Trigonometry 7. Binary mathematics and combinatorial problems in Chandaḥ Śāstra 8. Magic squares in India	**4**
Unit V: Astronomy:	
1. Introduction to Indian astronomy 2. Indian contributions in astronomy 3. The celestial coordinate system 4. Elements of the Indian calendar 5. Notion of years and months 6. Pañcāṅga – The Indian calendar system 7. Astronomical Instruments (Yantras) 8. Jantar Mantar of Rājā Jai Singh Sawai	**6**
Unit VI: Engineering and Technology: Metals and Metalworking:	
1. Wootz Steel: The rise and fall of a great Indian technology	**4**

2. The Indian S & T heritage 3. Mining and ore extraction 4. Metals and metalworking technology 5. Iron and steel in India 6. Lost wax casting of idols and artefacts 7. Apparatuses used for extraction of metallic components	
Unit VII: Engineering and Technology: Other applications:	
1. Irrigation systems and practices in South India 2. Literary sources for science and technology 3. Physical structures in India 4. Irrigation and water management 5. Dyes and painting technology 6. The art of making perfumes 7. Surgical techniques 8. Shipbuilding 9. Sixty-four art forms (64 Kalās) 10. Status of Indigenous S & T	**6**
Unit VIII: Town Planning and Architecture:	
1. Perspective of Arthaśāstra on town planning 2. Vāstu-śāstra – The science of architecture 3. Eight limbs of Vāstu 4. Town planning 5. Temples in India: marvelous stone architecture for eternity 6. Temple architecture in India 7. Iconography	**4**
Unit IX: Knowledge Framework and classifications:	
1. Indian scheme of knowledge 2. The knowledge triangle 3. Prameya – A vaiśeṣikan approach to physical reality 4. Dravyas – the constituents of the physical reality 5. Attributes – the properties of substances and Action – the driver of conjunction and disjunction 6. Sāmānya, viśēṣa, samavāya 7. Pramāṇa – the means of valid knowledge 8. Saṃśaya – ambiguities in existing knowledge 9. Framework for establishing valid knowledge 10. Deductive or inductive logic framework 11. Potential fallacies in the reasoning process 12. Siddhānta: established tenets in a field of study	**8**
Unit X: Linguistics	
1. Introduction to Linguistics 2. Aṣṭādhyāyī 3. Phonetics 4. Word generation 5. Computational aspects	**4**

6. Mnemonics 7. Recursive operations 8. Rule based operations 9. Sentence formation 10. Verbs and prefixes 11. Role of Sanskrit in natural language processing	

Suggested Reading:

1. *Austin Granville- The Indian constitution: Cornerstone of a Nation.*
2. *Seervai H.M. - Constitution of India*

Program: B.Tech
Semester: Five
Course: Plastic Waste Management
Course Code: 8OEC302

L	T	P	C
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Course Learning Objective:

CLO 1: Understand basics of waste management.

CLO 2: Study the linkage between economic growth and pollution and Role of economics in waste handling.

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: Understand the Plastics Waste & related term.

CO 2: Get acquaintance with waste management systems.

CO 3: Acquire knowledge about waste treatment technologies and know the need for integrated waste management.

CO 4: Know Current practices of plastic waste management and identify the best way to manage plastic waste and mitigate the risk.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction to Plastics Waste ,Definitions of related terms – Waste Plastic, Industrial Plastic Waste, Postconsumer Plastic Waste, Nuisance Plastic, Scrap Plastic, Primary Recycling, Secondary Recycling, Tertiary Recycling And Quaternary Recycling.	
Unit II:	**8**
Economic and environmental impact of Plastic Waste ,Sources of waste – postconsumer, municipal and industrial waste and Management of plastic waste - 4 R (reduction, reuse, recycling and recovery) and Impact of Plastics on Marine Life, Effect on Wildlife, Human Health and Environment.	
Unit III:	**8**
Plastic cycle - flow of plastic products and plastic waste , Waste disposal a. Landfill of municipal solid waste– open dumping and sanitary landfill b. Plastics in landfill c. Future trends.	
Unit IV:	**6**
Plastic Waste Management Practices – Use of Plastic waste in roads, issues and challenges, Possible Alternate Materials to Plastics –Greener Alternatives and Plastics Resource Recovery and Circular Economy.	

Suggested Reading:

1. *Handbook of Solid Waste Management, Tchobanoglous G and Kreith F, McGraw-Hill Education, 2002, 2nd Edition*
2. *Geotechnical Aspects of Landfill Design and Construction, Qian X, Koerner R M and Gray D H, Prentice Hall, 2002, 1st Edition*
3. *Hazardous Wastes - Sources, Pathways, Receptors, Richard J. Watts, John Wiley and Sons, 1998, 1st Edition.*

Program: B.Tech
Semester: Five
Course: Entrepreneurship
Course Code: 8OEC303

L	T	P	C
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Course Learning Objective:

CLO 1: The basic object of the course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship..

CLO 2: To learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: To learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

CO2:. Understand the project Identification, demand analysis

CO3: Understands the market planning, growth and control.

CO4: Know the Challenge in concerning Entrepreneurship.

Course Content:

Topics	Hours
Unit 1:	**10**
Entrepreneurial Perspectives: Introduction to Entrepreneurship – Evolution - Concept of Entrepreneurship - Types of Entrepreneurs - Entrepreneurial Competencies, Capacity Building for Entrepreneurs. Entrepreneurial Training Methods - Entrepreneurial Motivations - Models for Entrepreneurial Development - The process of Entrepreneurial Development.	
Unit II:	**8**
New Venture Creation :Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.	
Unit III:	**6**
Managing Marketing and Growth of Enterprises: Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.	
Unit IV:	**8**
Strategic perspectives in Entrepreneurship: Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship.	

Suggested Reading:

1. *Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.*
2. *Entrepreneurship, a South – Asian Perspective, D.F. Kuratko and T. V. Rao, 3e, Cengage, 2012.*
3. *Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.*
4. *The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.*

Program: B.Tech
Semester: Five
Course: Vocational Trainee Report
Course Code: 8PROJMiE301

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Course Learning Objective:

CLO 1: To provide training in mines for gaining thorough understanding of all the theoretical knowledge.
CLO 2: Gaining practical experience is an important aspect of the mining engineering program having many characteristic features of its own.
CLO 3: The students will have insight about mining methods and techniques.
CLO 4: The outcome at the place of work is always much more than what can be learned in the class room.
CLO 5: To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.
CLO 6: To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Mining graduates would be equipped with managerial skill which would be useful to them for achieving their program educational outputs.

Course Content:
1. Study of History of Mine – Note name of the Owner, Agent, Manager, Safety Officer
2. Study of Mine geological information
3. Study of Mine Plans and Sections
4. Study of Surface features related to Mine
5. Study of method of working
6. Study of method of blasting
7. Study of Transportation system and layouts
8. Study of Ventilation systems and layouts
9. Study of Drainage system
10. Study of Pit top and Pit bottom layouts.
11. Study of man Power plan
12. Develop the Lamp room layout and Magazine Layout
13. Draw the charts depicting instructional items related to Mining subjects

JHARKHAND Rai University RANCHI

SYLLABUS

SEMESTER VI

B.TECH

IN

MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Six
Course: Mining Machinery II
Course Code: 8PCCMiE306

L	T	P	C
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Course Learning Objective:

CLO 1: The students will get exposure towards the material handling methods and systems and its principle to convey the minerals or materials from mines, plants and workshops.
CLO 2: The students will have practical knowledge about underground machineries, ropes, pit-top and pit-bottom layouts.
CLO 3: Enables students about the conveyor system and its advancement.
CLO 4: To understand riding system and aerial system

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: Learn the basic concept of mine machinery for selecting the suitable machines and solving the excavating, loading & transportation problems in mine.
CO2: Explain the designing the open pit and layout of the haulage system and construction of bunker for storage of coal.
CO3: Understand the knowledge on wining system &choosing of appropriate conveying system and its control in the mine.
CO4: Apply the knowledge of construction &installation of aerial ropeway and man ridding system and its statutory provision.

Course Content:

Topics	Hours
Unit 1:	**10**
Surface Machinery: Construction and operation of blast hole drills, rippers, shovels ,hydraulic excavators, scraper, dragline, dumpers, wheel loaders, dozers, graders, surface miners, BWE, spreader, stacker &reclaimer.	
Unit II:	**8**
Pit Layout: Surface and Underground Layout Pit top and pit bottom circuits. Surface structures- Surface handling systems – coal and ore handling plants. Storage bunkers. Railway siding. Classification, application, constructional features of drilling machines used in coal and metal mining, Coal cutters, shearer, plough, continuous miner, road header and dint header.	
Unit III:	**8**
Trackless Transport System: Types of conveyors and their sequence control, High-capacity belt conveyors–constructional detail and selection procedures and High angle conveyor. Free steered vehicles - Shuttle cars, LHD, SDL.	
Unit IV:	**6**
Aerial Ropeways: Types, construction, classification, layout and constructional features. Loading, unloading and angle stations, Man-riding Systems Statutory Provisions; Man riding systems -Loading and transport equipment.	

Suggested Reading:

1. *Voll-II, D.J. Deshmukh, Central Techno Publication, Nagpur*
2. *Mine pump, haulage, winding, Ghatak, Coal Field Publisher Asansol.*

Program: B.Tech
Semester: Six
Course: Underground Metal Mining
Course Code: 8PCCMiE307

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The students will have good knowledge about the various advanced methods of metal mining and special mining techniques to overcome the field issues.

CLO 2: The students will have basic concept on metal mining methods, mine design, development and operations of metal mines. They will also know about novel methods of metal mining and its applications.

CLO 3: To understand the various advanced and recent methods of metal mining.

CLO 4: Enables the students to select suitable methods of working underground metal mines and decide the necessary parameters of mine construction.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Develop the understanding of metal mining industry.
CO 2: Sketch the development of a working underground metal mines.
CO 3: Acquire knowledge and hands-on competence in applying the concepts in the design of metal mine.
CO 4: Recommend the various support system for underground metal mine working.

Course Content:

Topics	Hours
Unit 1:	**4**
Introduction: Present status of Indian metal mining industry; Scope and limitations of underground mining. **Development:** Choice of level interval and back/block length; Shape, size, position, excavation and equipping of shaft, grizzly, ore/waste bin, main ore pass system, underground crushing and loading stations; Cross-cuts and drifts their shape, size and position; mucking, ventilation and support; Use of modern drilling and loading equipment in drifting;	
Unit II:	**12**
Raisin: Raises and winzes their shape, size and position; Excavation process ground breaking, mucking, ventilation and support ; Modern methods of raising-Alimak and Jora raising, long hole method including vertical crater retreat method of raising; Raise boring systems and their types.	
Unit III:	**8**
Stoping : Selection of stoping methods; Classification of stoping methods; Stoping of narrow ore bodies by underhand, overhand, breast, long hole and raise mining methods; Resuing; Mining of parallel veins; Room & pillar, sublevel, large diameter blast hole/DTH, shrinkage and vertical crater retreat methods, their applicability, stope layouts ,stope preparation, ground breaking, mucking, ventilation and supporting; Haulage and dumping;	
Unit IV:	**8**
Supported methods–Horizontal over hand and under hand cut-and-fill methods, square-set method and its variations, details of, ground breaking, supporting, mucking and ventilation, Block Caving and Sub level stopping method.	

Suggested Reading:

1. *Elements of Mining Technology Vol I, II, D.J. Deshmukh, Central techno publication, Nagpur*
2. *Surface Mining, G.B. Misra, Oxford University Press, Calcutta*
3. *Introductory Mining Engineering, H.L. Hartman, A Wiley Interscience Publication, Singapore*

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Program: B.Tech
Semester: Six
Course: Advanced Underground Mining
Course Code: 8PCCMiE308

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: To introduce the recent trends of level of mechanization for coal face.
CLO 2: To understand the various advanced methods of coal mining.
CLO 3: To study the various special methods of winning coal.
CLO 4: To study the development of panels and extraction of coal in Bord and Pillar method.
CLO 5: The students will have knowledge on development and depillaring of coal in Bord and Pillar and advancing and retreating in Longwall methods. They will also know about novel methods of winning of coal.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Define & explain the underground mining of thick seam & hydraulic mining.
CO 2: Analyze the design of thin seam mining method in underground & coal gasification techniques.
CO 3: Describe the working methods & present status of underground metal mining.
CO 4: Design & solve the deep mining method & special mining methods.

Course Content:

Topics	Hours
Unit 1:	**8**
Underground Coal Mining of thick seams: Concept of a thick seam; Problems of mining thick seams; Past experience of working thick seams by Bord & Pillar method in multi-sections; Longwall based multi-slice methods:- Inclined slicing, horizontal slicing and cross-slicing in ascending and descending sequence; Under winning methods:-sub-level caving, integral caving, blasting gallery method, descending shield method.	
Unit II:	**8**
Hydraulic Mining of Coal: Conditions suitable for hydraulic Mining of Coal, Hydraulic Mining Operation, Hydraulic breaking of coal, hydraulic transport and hydro hoisting; Layout of workings for hydraulic mining of moderately thick seams.	
Unit III:	**8**
Underground Coal Gasification: Conditions suitable for Underground Coal Gasification; Basic principle and technology of underground coal gasification, Advantage and disadvantage of UCG: Scope of application of UCG in Indian conditions.	
Unit IV:	**6**
Deep mining: Problems of deep mining and the remedial measures; Special methods: Hydraulic, thermal, hydro chemical and biochemical methods; placer mining; Highwall Mining: Introduction, Applicability and Method.	

Suggested Reading:

1. *Elements of Mining Technology Vol I, II, D.J. Deshmukh, Central Techno Publication, Nagpur*
2. *Surface Mining, G.B. Misra, Oxford University Press, Calcutta*
3. *Introductory Mining Engineering, H.L. Hartman, A Wiley – Inter science Publication, Singapore.*

Program: B.Tech
Semester: Six
Course: Applied Rock Mechanics
Course Code: 8PCCMiE309

L	T	P	C
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Course Objective:

CLO 1: The students will have knowledge on rock mechanics instrumentation, approach to pit slope stability, theories of subsidence and failure of rocks.

CLO 2: The students will have knowledge on time dependent properties of rock, subsidence, ground vibration monitoring, stowing characteristics and permeability.

CLO 3: They will also know about design of underground opening and methods of stowing.

CLO 4: Student will know about subsidence control, governing norms and regulations.

CLO 5: The students will know the fundamental mechanics of rock slope failure, types of failure and its influencing parameters.

CLO 6: The students will have the concept about the rock mass classification, mechanism of rock reinforcement, existing and special methods of rock reinforcement.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Sketch of strata control for understanding, formulating and solving strata control problem in any underground mine.
CO 2: Analyze and solve strata movement problems.
CO 3: Acquire knowledge and hands-on competence in applying the concepts in the development of strata control.
CO 4: Describe subsidence & develop in depth knowledge of monitoring prediction & control.

Course Content:

Topics	Hours
Unit 1:	**10**
Engineering classification of rocks and rock masses: Classification systems in rock engineering; Classification of intact rocks; Classification of rockmasss-RQD, Rock Structure Rating, Bieniawski's RMR, Barton's Q-System Rock mass classification and Recent developments; correlations between different classification systems; Applications of Rock mass Classification in rock engineering.	
Unit II:	**10**
Design of mine pillars: Mine pillars and their classification; pillar mechanics; Design of mine pillars and shaft pillar: stresses acting on pillars; stress distribution in pillars; mechanics of pillar failure.	
Unit III:	**8**
Rock support: principles of supports; Types and classification of support; support design methodology; support design criteria; rock- support interaction analysis; support requirement under different conditions – influencing parameters, selection and estimation. Design of rock reinforcement for underground excavation: Development of reinforcement by rock bolting; rock bolt types; theories of rock bolting; design of rock reinforcement system.	
Unit IV:	**8**
Subsidence: Causes and impacts of subsidence; Mechanics of surface subsidence, discontinuous and continuous subsidence; Monitoring, prediction, control and management of subsidence. Rock burst and coal bump: Phenomenology of rock bursts and coal bump; causes prediction, monitoring.	

Suggested Reading:

1. *Elements of Mining Technology Vol, I, D.J. Deshmukh, Central techno publication, Nagpur*
2. *Modern Coal Mining Technology, S.K. Das, Mintech publication Bhubaneshwar*
3. *The Elements of Mechanics of Mining Ground, B.S. Verma, Tuhin& Co. Lucknow*

Program: B.Tech
Semester: Six
Course: Applied Rock Mechanics Lab
Course Code: 8PCCMiE09P

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List of Experiments:

1. Study of Anchorage strength of rock bolt.
2. Study of Modulus of elasticity of rock.
3. Load cell, extensometer, vibrating wire stress meter and convergence meter.
4. Use of Sylvester prop.

Program: B.Tech
Semester: Six
Course: Mine Environmental Engineering
Course Code: 8PCCMiE310

L	T	P	C
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Course Learning Objective:

CLO 1: The students will have knowledge on spontaneous heating, mine fires, inundation and explosions.
CLO 2: To study about mine rescue and first aid.
CLO 3: The students will get practical knowledge about underground mine ventilation methods and planning.
CLO 4: The students will have deep knowledge about the mine accidents, disaster, disease and mine Safety with risk assessment, mitigation and management.

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: Understand the basic concept of mine fire & spontaneous combustion with detection, control, dealing and prevention in underground mine.
CO2: Explain the causes & prevention of mine explosions like firedamp & coal dust explosion.
CO3: Gain knowledge of causes & prevention of inundation and uses of the rescue apparatus properly.
CO4: Analyze the causes of production of air born dust and its control as well as prevention and the standard of illumination at working place and other parts of the mine.

Course Content:

Topics	Hours
Unit 1:	**10**
Mine fires: Causes and classification of mine fires; Spontaneous combustion mechanism, stages of spontaneous combustion, susceptibility indices, factors affecting spontaneous combustion; Detection and prevention of spontaneous heating and accidental fires; Dealing with mine fires direct and indirect methods, fire stopping; Re-opening of sealed-off areas; Fires in quarries, Coal stacks and waste dumps.	
Unit II:	**6**
Mine explosions: Firedamp and coal dust explosions causes and prevention, explosive limits; Stone- dust and water barriers; Explosion in quarries over developed pillars; Investigation after an explosion.	
Unit III:	**8**
Inundation: Causes and prevention; Precautions and techniques of approaching old workings; Dewatering of waterlogged working, safety boring apparatus, pattern of holes; Design and construction of water dams. Rescue and recovery**:** Rescue equipment and their uses, classification of rescue apparatus; Resuscitation; Rescue stations and rescue rooms; Organization of rescue work; Emergency preparedness and response system.	
Unit IV:	**6**
Air borne reparable dust: Generation, dispersion, measurement and control; Physiological effects of dust, dust-related diseases. Illumination: Cap lamps; Layout and organization of lamp rooms; Standards of illumination; Photometry and illumination survey; Lighting from main and other sources.	

Suggested Reading:

1. *Elements of Mining Technology Vol II, D.J.Deshmukh, Central Techno Publication, Nagpur*
2. *Mine Environment & Ventilation, G.B.Misra, Oxford University Press, Calcutta*
3. *Mine Disaster & Mine Rescue, M.A. Ramlu, Oxford University Press, Calcutta*

Program: B.Tech
Semester: Six
Course: Mine Environmental Engineering Lab
Course Code: 8PCCMiE310P

L	T	P	C
0	0	2	1

List of Experiment:

1. Detection of Methane using flame safety lamp.
2. Demonstration of whirling hygrometer and determination of relative humidity using whirling hygrometer.
3. Demonstration of Kata thermometer and determination of cooling power by Kata thermometer.
4. Demonstration of various ventilation devices.

Program: B.Tech
Semester: Six
Course: Computer Aided Mine Planning Lab
Course Code: 8PCCMiE311P

L	T	P	C
0	0	2	1

Course Learning Objective:

CLO 1: The students will have knowledge on planning of opencast mining, underground mining and equipment utilization.

CLO 2: To understand the planning of opencast mining, underground mining and equipment Utilization.

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: Design layout of opencast mine to know the calculation of output.

CO 2: Plan layout of opencast mine to know organizations charts for mine management**.**

CO 3: Analyze & draw layout of with a target output.

CO 4: Design layout of opencast mining with equipment scheduling.

List of Layout:

1. Determination of annual production capacity of a rope shovel with given bucket capacity, dumper capacity and numbers and distance of dumping yard.
2. Determination of annual excavation capacity of a dragline of given specification including bucket capacity.
3. Determination of total drilling requirement for an opencast overburden/ coal bench with given geometry and excavation volume/ production requirement per round of blasting.
4. Determination of matching number of dumpers per shovel for a target output when the shovel and dumper capacities are given.
5. Determination of volume of rock excavation in box cutting for a given geometry of the entry and depth of first bench.
6. Determination of haul road dimensions for a given condition. Study and sketch of an inclined drivage showing support requirements, transport mode, safety features, illumination etc.
7. Study and sketch of a conventional/ mechanized Bord and Pillar panel being developed.
8. Study and sketch of a Bord and Pillar panel being depillared with hydraulic sand stowing showing systematic support.
9. Study and sketch of a Bord and Pillar panel being depillared with caving showing systematic support.
10. Study and sketch of longwall main gate and tail gate roads with respective gate machineries.
11. To design the shovel – dumper combination for a given targeted output.

Program: B.Tech
Semester: Six
Course: Character Building and Holistic Development of Personality 3 (Universal Human Values and Ethics)
Course Code: 8VAC301

L	T	P	C
2	0	0	2

Course Learning Objective:

CLO 1: To familiarize students with Indian cultural values.

CLO 2: To inspire students to preserve and protect values and ethics.

CLO 3: To build moral, ethical, energetic individual dedicated towards the service of humanity.

CLO 4: To focus on holistic development of an individual.

Course Outcome:

On completion of the Course, the students will be able to:

CO 1: Understand the importance of Indian cultural values.

CO 2: Learn to adapt, protect and preserve values and ethics.

CO3: Become a responsible citizen for serving the mankind.

CO4: Develop one's personality holistically in a balanced manner.

Course Content:

Topics	Hours
Unit I: Personality Development	**4**
• Personality Development: Meaning, Concept, Constituent elements of personality and Means/Ways of Personality Development. • Panchakosha: General Introduction, Meaning, Objectives, Characteristics and Significance. • Benefits of Panchakosha, development and deficiencies due to underdevelopment of Panchkosha.	
Unit II: Mental Emotional Development	**4**
• Values and Individual: Non-Possession, Non- Stealing, Self Restrain, Enthusiasm, Dutifulnes, Reticence, Silence, Self-study, Considerateness and Self-respect. • Values and Family: Respectful Salutation, Obedience, Contentment, Patience, hospitality, Parent Service, Rectitude, Good Behaviour, Family feeling and worship.	
Unit III: Indian Values	**8**
• Values and Society: Discipline, Social Responsibility and Duties of Citizens, Altruism/ Charity, Keeping good company, Gratefulness, Fraternity/ Friendship, Courtesy, Tactfulness, Soft Spoken and Feeling for the Oppressed. • Values and Constitution: Dignity of an Individual, Fundamental Duties, Fundamental rights, Directive Principles of State Policies, Social Equality, Democracy, Justice, Freedom, Sarva-Pantha Samman and Scientific Approach.	
Unit IV: Practice of Values and Ethics	**8**
• Values and Indian Culture: Integrity of the nation, Glory of the Past, Swadeshi, Nation Building, Patriotism, Mother Tongue, National Unity, Public Welfare, Equality and Spirituality. • Values and Vision of the World: Humanity, Integrity, Human rights, The Highest or Most Sublime Good, Vasudhaiva Kutumbakam, Tolerance, Peaceful Coexistence, World-Welfare, Environmental Protection, Swavalamban/Self-reliance	

Suggested Readings:

1. *My Idea of Education, Swami Vivekanand, Advaita Ashram, Kolkata*
2. *Personality Development, Swami Vivekananda, Advaita Ashram, Kolkata.*
3. *The Man India Missed the Most; Subhash Chandra Bose, huvan Lall, Notion Press, Chennai*

OPEN ELECTIVE COURSE II (Any one of the following subjects)

Program: B.Tech
Semester: Six
Course: Data Analytics
Course Code: 8OEC304

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The basic object of the course is to provide the acquaintance with the basic features of Indian Constitution e.g. Fundamental Rights, Fundamental Duties and Directive Principles of State policy.
CLO 2: To impart the knowledge about Judicial system in India.

Course Outcome:

On the completion of the Course, the students will be able to:

CO1: Analyse data to evaluate meaningful pattern.
CO2: Demonstrate understanding of the mathematical foundations needed for data science.
CO3: Collect, explore, clean, manage and manipulate data.
CO4: Build data science applications using Python based toolkits.
CO5: Graphically interpret data using different statistical tool and hypothesis tests.
CO6: Develop intelligent decision support systems for various mining operations.

Course Content:

Topics	Hours
Unit 1:	**6**
Data Definitions and Analysis Techniques: Concept of Data Science, Why/When/What, application in real scenarios, Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming.	
Unit II:	**4**
Descriptive Statistics: Measures of central tendency, Measures of location of dispersions, Practice and analysis with R.	
Unit III:	**6**
Programming Tools for Data Science: Basics of Python (file handling, case-folding, spell check, split, strip, Regex, find, replace, etc.); Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK; Visualizing Data: Bar Charts, Line Charts, Scatterplots.	
Unit IV:	**6**
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing; Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Practice and analysis with R. Data analysis techniques: Regression analysis, Classification techniques, Clustering, Association rules analysis, Practice and analysis with R.	
Unit V:	**8**
Machine Learning: Overview of Machine learning concepts – Bias/variance, overfitting and train/test splits. Types of Machine learning – Supervised, Unsupervised, Semi-supervised.	

Suggested Reading:

4. *An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013*
5. *Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer*
6. *Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012*
7. *Advances in Complex Data Modeling and Computational Methods in Statistics, Anna Maria Paganoni and Piercesare Secchi, Springer, 2013*

Program: B.Tech
Semester: Six
Course: Course: Mine Automation & IOT
Course Code: 8OEC305

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: To make the students aware of the outline of managerial functions relating to manufacturing.
CLO 2: At the end of the course, the student should be able to understand the basic application of operational tools and manufacturing.
CLO 3: Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.
CLO 4: Learn various aspect of reliability

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Apply management practices & & practice the various management theory.

CO 2: Describe the effectively the formation of companies, financial analysis and costing, & operation Research.
CO 3: Identify strategies for deployment and management of human resources on organization.
CO 4: Understand Project management & assurance Sciences.

CO 5: To learn the basic concepts of IoT and different communication schemes and protocols used in IoT.

Course Content:

Topics	Hours
Unit 1:	**6**
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, Automation of drilling and drill rig, drilling process. Automation of underground loading and transportation systems. Automation in tunnelling projects. Automation in monitoring of environments in longwall and continuous mining system, Automation of transportation system in surface mining.	
Unit II:	**8**
Fleet Management System: TDS, CMMS, ERP for Mining Industry; Mining Remote Operations & Control: Robotics & Armchair Mining; Use of robotics in mining for production and disaster management purpose. Overview of Material Handling Systems - Principles and Design Consideration, Material Transport Systems, Storage Systems. (DCS - automation).	
Unit III:	**6**
Automated Communication and Tracking Technologies: Proximity Systems, GNSS/UPS, Vision Based Systems, Radar Systems, RFID and Geo-fencing, CCD camera, Data Logging Systems, SCADA, Image Processing etc.	
Unit IV:	**6**
Virtual Reality Applications: Mining Equipment Concept development, Mine Safety Applications, Mining operation simulations. Importance of sensor networking in mining and other safety critical industries.	
Unit V:	**6**
Introduction to IoT: functional layers of IoT, Sensing, Actuation, data warehousing and analytics. Basics of Networking, Communication Protocols, Networking Hardwares Sensor Networks: Machine-to-Machine Communications, Interoperability in IoT.	

Suggested Reading:

1. *G. Almgren, U. Kumar, N. Vagenas : Mine Mechanization & Automation 1st Edition Reference Books:*

2. *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*

3. *Peter V. Golde : Implementation of Drill Teleoperation in Mine Automation*

Program: B.Tech
Semester: Six
Course: Mine Electrical Engineering
Course Code: 8OEC306

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The basic object of the course is to provide the acquaintance with the basic features of Indian Constitution e.g. Fundamental Rights, Fundamental Duties and Directive Principles of State policy.

CLO 2: To impart the knowledge about Judicial system in India.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand different types of power supply systems and protection schemes used underground coal mines.
CO2: Understand different types of circuit breakers and relay used in Mines.
CO3: Analyze illumination, Intrinsically Safe circuit methods of attaining intrinsic safety, Zener safety barriers and their applications in mines.
CO4: Able to know the Earthing practice in mines and knowledge of Mining cables.

Course Content:

Topics	Hours
Unit 1: Types of electrical power supply systems for underground coal mines – solidly earthed, restricted neutral and insulated – neutral systems of electrical power supply; their comparisons.	**6**
Unit II: Earth fault protection techniques for above mine power supply systems, sensitive and fail-safe earth fault relays. On-line insulation monitoring for insulated-neutral electrical distribution system.	**4**
Unit III: Electrical power planning for mechanized longwall faces –general scheme of electrical power distribution, voltage drop problems and remedial measures; Inbye substation capacity selection. General scheme of electrical power distribution in opencast projects, Quarry substation capacity selection. Choice of restricted-neutral and insulated-neutral systems in open cast mines.	**6**
Unit IV: Earthing practice in mines – earth pits, earthing of mobile electrical equipment in mines. Mining cables – types, constructional details; layout of cables through shaft and other locations. Principles of flame proof enclosures. Intrinsically safe circuit methods of attaining intrinsic safety, zeener safety barriers and their applications. Indian electricity rules as applied to mines.	**6**

Suggested Reading:

1. *A Text Book on Power Systems Engineering – Soni Gupta, Bhatnagar, Chakarbarti, Dhanpat Rai & Sons.*
2. *Electrical Equipment in mines- H. Cotton.*
3. *Switchgear and Protection- S.S. Rao Khanna Publications.*
4. *Indian Electricity Rules.*

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SYLLABUS
SEMESTER VII

B.TECH
IN
MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Seven
Course: Mine Legislation and Safety I
Course Code: 8PCCMiE401

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The students will have knowledge on various acts, rules and regulations relating to the mineral industry.
CLO 2: Student will also know about accidents, diseases and mine safety.
CLO 3: To study various acts, rules and regulations relating to the mineral industry.
CLO 4: Students will be acquainted with rules, laws and order for running a mine.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Understand the knowledge on implementation of provisions of mines act related to Mine, Open cast working, underground working, Relay, Shift, Serious bodily injury, Provisions for health and safety, Provisions regarding leave with wages.
CO2: Apply knowledge of legislation in mines for the implementation of mine rules, various committee & provisions related to First Aid.
CO3: Learn the various duties & responsibilities of mine managers, Asst/under Managers, Overman, foreman and surveyor.
CO4: Explain the implementation of the safety management plan to reduce the accident and various type of mine accident.

Course Content:

Topics	Hours
Unit 1:	**8**
Mines Act 1952: Important definition: Adolescent, adult, child, Employed, Mines, Mineral, Open cast working below ground & above ground working, Relay, Shift, Reportable Injury, Serious bodily injury, owner, agent, manager, chief inspector & District Magistrate. Provisions regarding leave with wages, committees, Notice to be given of accident, Notices of certain diseases, Hours & Limitations of Employment; Provisions regarding health & safety, Drinking water, Conservancy, medical appliances. Power of Inspector when employment of person is dangerous, power of government to appoint court of enquiry, power of central government regarding making of rules, regulation & bye laws etc, penalty & procedure.	
Unit II:	**8**
Mines Rules 1955 (Amended up-to- date): Important Definition, Provision regarding committee, provision regarding court of inquiry, certifying surgeon, Medical Examination of person employed/ to be employed in mines, Provision of workmen inspector & safety committee, Provisions related to health & sanitation and provisions related to First Aid & medical appliances, first aid room, first aid station and welfare amenities, Registers, Notices & returns etc. Hours and limitations of Employment - leave with wages - with wages and over time.	
Unit III:	**8**
Coal Mines Regulations 2017(Amended up-to- date): Definitions, Important provisions regarding returns; notices and records; Examination, Certificate of competency and of Fitness; Inspectors and Mine officials; Plans and sections including schedule; Duties & responsibilities of Mine management, contractors, manufacturers, officials, competent person and workmen, Important provisions regarding Means of access & egress, winding in shaft, & haulage, Provisions regarding mine working, precautions against danger from fire, dust, gas and water, Important provisions regarding mine ventilation, Important provisions regarding explosives & shot firing, Provisions regarding extraction of methane from working coal mine or abandoned coal mine, Important provisions regarding lighting & safety lamps, machinery plant & equipment, miscellaneous etc.	
Unit IV:	**6**
Metalliferous Mines Regulations 1961 (Amended up-to- date): Important definitions regarding retruns, notices and records, examination & certificates of competency and of fitness , Inspector and Mine officials; Duties & responsibilities of workmen , competent persons and officials etc. Mine plans and sections. Means of Access and egress ladder and Ladder ways under M.M.R.	

Transport of men and material by Haulage mine working, precautions against dangers from gas and water Mine ventilation, mine lighting and safety equipment and types of fences (Miscellaneous).	

Suggested Reading:

1. *Central Government, Mines Act 1952, Lovely Prakashan, Dhanbad*
2. *Central Government, Mines Rules 1955, Lovely Prakashan, Dhanbad*
3. *Central Government, Coal Mines Regulation 1957, Lovely Prakashan, Dhanbad*
4. *Central Government, DGMS Circulars, Lovely Prakashan, Dhanbad*

Program: B.Tech
Semester: Seven
Course: Mine Hazards & Risk
Course Code: 8PCCMiE402

L	T	P	C
3	0	0	3

Course Objective:

- After completion of this course student will create a ventilation system for a mine to provide safe work/operating environment.
- Upon completion of this course, the students can Understand mine safety management systems, operational risk assessment, and occupational health and safety and remember the factors contributing to safety and risk management in specific mining-related processes.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Understand mine safety management systems, operational risk assessment, and occupational health and safety.
- CO 2: Remember the factors contributing to safety and risk management in specific mining-related processes.
- CO 3: Analyse causes and consequences of mining-related serious incidents (due to both environmental and geotechnical aspects), and associated risk management strategies and control measures.
- CO 4: Create a safe mine design by applying the principals of pillar design, mine subsidence and ground control.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction: Definitions of safety, hazard, risk and accident, classification of accident/injury, cost of accident, DGMS proposed risk analysis procedure, NIOSH proposed risk analysis procedure.	
Unit II:	**8**
Risk Management: Risk Management related terms and definitions; Basic concept of risk; Difference between hazards and risks; Risk components and types, Risk management objectives, Risk management process; Risk analysis objectives in hazardous system life cycle; Functions of a risk manager; Hazards Identification and Risk Assessment (HIRA); Implementation of HIRA and its Controls & Review; Advantages of Risk Management.	
Unit III:	**8**
Risk Analysis Methods: Hazard and Operative (HAZOP) Analysis; Failure Mode and Effect Analysis (FMEA); Failure Mode Effect and Critical Analysis (FMECA); Job Safety Analysis (JSA); Preliminary Hazard Analysis (PHA); Appraisal of advanced techniques , Fault Tree Analysis (FTA).	
Unit IV:	**6**
System Safety Engineering Approach: System safety engineering definitions; system safety engineering approaches; Domino model, Human Factors Analysis and Classification System (HFACS) using The "Swiss Cheese" model.	

Suggested Reading:

1. *Progressive Technologies of Coal, Coal bed Methane, and Ores Mining by Volodymyr Bondarenko, Iryna Kovalevs'ka*
2. *Advanced Reservoir and Production Engineering for Coal Bed Methane by Pramod Thakur*
3. *Fundamentals of Coal bed Methane Reservoir Engineering by John Seidle*

Program: B.Tech
Semester: Seven
Course: Mine Planning
Course Code: 8PCCMiE403

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: To introduce the various techniques for mine planning, geotechnical investigation and equipment management.
CLO 2: To appreciate the modern trends in opencast mines, safety and environment.
CLO 3: The students will have knowledge about the available mineral resources, exploration techniques and its strategy. They will know about the methods of preparation of feasibility reports and its evaluation techniques.

Course Objective:

On the completion of the Course, the students will be able to:
CO 1: Apply knowledge of mine planning for understanding, formulating and solving mine planning &scheduling problems.
CO 2: Describe stripping ratio and opencast working & geometry.
CO 3: Acquire knowledge and hands-on competence in applying the concepts in the development of mine planning.
CO4: Analyze feasibility & detailed report of opencast mining.

Course Content:

Topics	Hours
Unit 1:	**8**
Basic Concepts: Objectives of mine planning. Characteristics of planning process. Planning stages – long, intermediate and short range planning. Technical, economical and environmental information required for mine planning. Preparation of Feasibility and Project Report.	
Unit II:	**10**
Planning and Design of Surface Mine: Concepts of stripping ratios – Types of stripping ratios and their significance. Geometrical considerations for design of surface mines: Pit geometry, Pit layouts – Mine access, pit expansion and push back operation. Pit design and ore reserve estimation, Development of economic block model, cut-off grade and its estimation; Production scheduling and equipment system selection – Production scheduling concepts, optimum mine size and Taylor's mine life rule, selection of equipment system and scheduling Design of haul roads- Geometrical, Structural, Functional and Safety features.	
Unit III:	**8**
Underground Mine Planning: Underground Coal Mine Planning- Sizing of mine; Optimization of mine size (mine production capacity) based on techno-economic considerations; Equipment and face scheduling against targeted production.	
Unit IV:	**6**
Feasibility Report and Detailed Project Report: Contents, preparation and economic evaluation. **Mine closure planning**: Initial, Progressive and Final Mine closure Planning and its components; Auditing; Legal and Financial Aspects.	

Suggested Reading:

2. *Elements of Mining Technology Vol I, II, D.J. Deshmukh, Central techno publication, Nagpur*
3. *Surface Mining, G.B. Misra, Oxford University Press, Calcutta*
4. *Introductory Mining Engineering, H.L. Hartman, A Wiley- Interscience Publication, Singapore.*
5. *Principles of Mine Planning, Jay ant Bhattacharjee*

DEPARTMENTAL ELECTIVE COURSE I (ANY ONE OF THE FOLLOWING SUBJECTS)

Program: B.Tech
Semester: Seven
Course: Mine Closure
Course Code: 8DECMiE401

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The course is designed to ensure long term physical, chemical and biological stability of the site to minimize potential environmental and health risk.
CLO 2: They can know about various process and rules related to mine closure.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Know the insight into mine closure plan
CO2: Prepare a mine closure plan
CO3: Know the various legal aspects related with mine closure
CO4: legal aspects of mine closure to comply with uninterrupted mining process.

Course Content:

Topics	Hours
Unit 1:	**8**
Mine closure planning: importance, methodology, statutes concerning mine closure.	
Unit II:	**8**
Principles, planning, financial provisions, implementation, standards for closure criteria, systems approach for mine closure. Various legal aspects of mine closure planning, its advantages and amendments.	
Unit III:	**8**
Guidelines from ministry of environment and forest. Mine closure plan, guidelines for preparation of mine closure plan.	
Unit IV:	**6**
Standards of Mine Closure in Indian Mines, components, process, monitoring rules.	

Suggested Reading:

1. *Guide for mine closure planning, Sánchez, L.E.; Silva-Sánchez, S.S.; Neri, A.C, Brasília,*
2. *2014, IBRAM – Brazilian Mining Association.*
3. *Mine Closure - A. Robertson & S. Shaw*
4. *Mineral Conservation and Development Rules, 2017, Indian Bureau of Mines*
5. *Guidelines for preparation of Mine Closure Plan, Ministry of Coal, GOI*

Program: B.Tech
Semester: Seven
Course: Dimensional Stone Mining
Course Code: 8DECMiE402

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The course is designed to help the student in understanding the different methods to mining and processing also extraction methods of dimensional stone.
CLO 2: They can know about various properties of dimensional stone and various machines to use for extraction of dimensional stone.
CLO 3: After learning this course the students should be able to understand the different method to mining and processing also extraction methods of dimensional stone.
CLO 4: To know the hazard of dimension stone mining.

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Apply knowledge on small scale & dimensional stone mining for understanding, formulating and solving problems related with small scale mining.
CO2: Apply skill on selecting the equipments and cutting tools as per physical properties of material for designing and development of small scale mine.
CO3: Apply knowledge of extraction of dimension stone.
CO4: Apply the skill on preventive measures for the hazard caused due to dimension stone mine.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction: Definition, historical use of natural stones. Geology and occurrences: Classification of dimensional stones, composition, chemical and geo-chemical properties, various standards for normalization of dimensional stones. Mining of dimensional stones: Various techniques of dimensional stones mining–block mining and slab mining; Manual mining; Mechanized mining–line drilling, in-situ sawing by wire saw, chain saw, portable circular saw, flame cutting.	
Unit II:	**8**
Cutting/Sawing tools: Tool carrier–circular steel blade, steel wire rope, chain jib saw ,physical and mechanical properties, elastic properties, tension etc.; Cutting tools– diamond segments, diamond pearls/ bits, tungsten bits etc.; Process of manufacture, ingredients, brazing /fitting, wearing pattern and control; Cost of cutting. Handling of blocks and slabs: Equipment used derrick crane, front loaders, fork-lifts, mobile cranes, trucks and trailers.	
Unit III:	**8**
Quarrying machines for dimensional stones: Portable circular saw, wire saw, chain saw, line drills–special design features of the machines, techniques of use and maintenance. Production monitoring: Recovery, waste generation, productivity, inherent defects, measurement and corrective actions, cost evaluation. Environmental issues: Management of solid waste, slurry waste, soil and water; Protection and rehabilitation.	
Unit IV:	**10**
Health, safety and welfare: Protective care from abrasive dust, personal safety and welfare. Application, processing and architecture in dimensional stone: Application–flooring, roofing, cladding, stairs, paving, facets; Processing and polishing –various techniques for sawing of blocks, shaping of edges, polishing and calibration; Fixing and installation–techniques of fixing of dimensional stones in various applications like flooring, cladding, faces, stairs, roofing and paving; Care and maintenance of dimensional stones–techniques for post fixing care and maintenance of dimensional stones in various applications.	

Suggested Reading:

1. *Hand Book On Safety In Mines & Dimension Stone Quarries, Mines Group Vocational Training Society, Hospet*
2. *A Text-Book Of Ore And Stone Mining (1894) By* ***Sir Clement Le Neve Foster***

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L	T	P	C
3	0	0	3

Program: B.Tech
Semester: Seven
Course: Design of Open Pit Mines
Course Code: 8DECMiE403

Course Learning Objective:

CLO 1: This course discusses the geological model and its purpose of linking the regional physical geology and the events that lead to the formation of the ore body to a mine-scale description of the setting.
CLO 2: Discusses the distribution and nature of the overburden soils and rock types at the site, including the effects of alteration and weathering.
CLO 3: Aware about the new techniques to design open cast mines and analyze the surface mining parameters.
CLO 4: Learn about the different hazard in open pit

Course Outcome:

On the completion of the Course, the students will be able to:
CO1: Explain the knowledge of planning process of open pit mine& reserve estimation.
CO2: Analyze the pit design and synthesis of short term planning and to control and influence production scheduling processes.
CO3: Understand the development of infrastructural facilities such as communication, power supply, beneficiation plants and mineral handling plants etc. and able to design various kind of open pit working.
CO4: Apply knowledge on Controlling of opencast mining induced hazards- rock fall, fly rock, blast vibration, noise and mine dusts.

Course Content:

Topics	Hours
Unit 1:	**8**
Preliminary evaluation of deposits, different stages of exploration, drilling for grade and geo-technical information. Calculation of reserves, Collection of planning information.	
Unit II:	**8**
Mine Life: Determination of optimum output, life of a mine and size of mine field based on economic consideration, Taylor's mine life rule. Optimal size and output different stages of development, design of pit layout and method of advance. Selection of open cast equipments and equipment scheduling, Design for unit operations, rock breaking, excavation, transportation, storage and dumping.	
Unit III:	**8**
Development of infrastructural facilities-communication power supplies, illumination, dewatering and other maintenance services, Site selection for mineral handling/ beneficiation plant.	
Unit IV:	**6**
Control of opencast mining induced hazards- rock fall, fly rock, blast vibration, noise and mine dusts. Planning for reclamation of mined out area.	

Suggested Reading:

1. *Open Pit Mine Planning and Design,William A. Hustrulid,Mark Kuchta*
2. *Open Pit Mine Planning and Design , William A*

Program: B.Tech
Semester: Seven
Course: Mine Management
Course Code: 8DECMiE404

L	T	P	C
3	0	0	3

Course Objective:

- Students gain knowledge on the basic management principles to become management(s) professional.
- Students will be acquainted with rules, laws and order for running a mine.
- At the end of the course, the student should be able to the students would be able to understand the basic application of operational tools and manufacturing**.**
- **Develop leadership and a good communication skill**

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Summarize the evolution theory of management and sketch the structure & design of organization.
- CO 2: Acquire knowledge and hands-on competence in applying the concepts of management in the development of mine economics.
- CO 3: Analyze and solve financial management problems.
- CO 4: Illustrate leadership skills and be able to be knowledgeable in behavioral science

Module 1

Introduction: Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organization and control; structure and design of organization for mining enterprises.

Module 2

Personal Management: Selection; training and development of human resources formining enterprises; leadership; study of traditional leader behaviour; autocratic; democratic and Laissez-Faire behaviour.

Module 3

Financial Management: Capital budgeting; techniques for mining project; project evaluation; payback period and IRR; methods of cost analysis and cost control; breakeven charts; working capital management. Materials Management: ABC Analysis, Inventory Management; Purchase policies, P and Q system, inventory control, Review period, lead time.

Module 4

Behavioural Sciences for Management: Conflict management; conflict in organization; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth; Individual motivation; two-way personal communication. Maintenance Management: Definition, Classifying Reliability, Types of Maintenance; Break-down, scheduled, preventive, predictive, protective and lean maintenance.

Suggested Reading:

1. *Mine Management Legislation (up to 2004)[Vol.I to VII] (Coal) by H P Soni*
2. *Hand Book of Mine Management Legislation & General Safety by R K Raman*

Program: B.Tech
Semester: Seven
Course: Mine Ventilation Planning
Course Code: 8DECMiE405

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Apply ventilation principles to mine design
CLO 2: Quantify ventilation requirements.
CLO 3: Identify risks associate with ventilation management.
CLO 4: Identify controls to manage ventilation.
CLO 5: Determine fan / system performance and specification of requirements in complex coal and metalliferous ventilation systems, including trouble shooting and problem solving.
CLO 6: Identify the requirements, and issues associated with, the application of appropriate ventilation monitoring systems in both coal and metalliferous mines.

Course Outcome:
On the completion of the Course, the students will be able to:
CO1: To familiarize with the steps in ventilation planning.
CO2: Know the various types of ventilation system.
CO3: To know the various causes of leakage of air.
CO4: To have the knowledge of effects on various leakage of air.

Course Content:

Topics	Hours
Unit 1:	**6**
Ventilation planning: Objectives and steps in ventilation planning, system analysis of the planning procedure, desirable features of ventilation systems, ventilation plans. Types of ventilation system, Central, Boundary and Combined ventilation systems, Air distribution with different mining methods: Board and Pillar method, Longwall methods, Shrinkage and Cut and Fill stopes, Open and Underhand stopes, Sublevel stopes. Top slicing and Sub-level caving, Block caving.	
Unit II:	**6**
Air quantity requirement: Air quantity requirement in the workings, Strata gas, Diesel exhaust fumes, dust, heat, workshop and other ancillary areas, air requirements in drifts and tunnels, leakage of air, expansion in upcast, air velocities. Pressure Requirement, Selection of fans, output control in fans, series and parallel combination of mine fans, forcing and exhaust, maintenance and monitoring of fans, booster fans, auxiliary ventilators, fan installations, diffuser and evasee.	
Unit III:	**10**
Network Analysis: solution of complex ventilation network, solution by Hardy Cross Method of successive approximation, ventilation network analysis by digital computer, recent development in ventilation planning.	
Unit IV:	**8**
Ventilation Economics: Analysis of ventilation cost, Interest payments, time value of money, present value, Equivalent annual cost, ventilation operating cost, optimum size of airway and shaft.	

Suggested Reading:

1. *Misra , G.B.,(1964) mine ventilation, thacker spink &Co.*
2. *Rouse,H., (1956), elementary of mechanis of fluids , Jhon wiley and Sons Inc.*
3. *Ower.E., (1949), the measurement of air flow, 3rd ed, Chapman and Hall, London.*
4. *'mine fans', (1952), N.C.B bull.66.*
5. *Bromilow, J.G., (1962), ventilation of mechanised heading', Jr. Min met. F. special issue.*

Program: B.Tech
Semester: Seven
Course: Seminar in Executive Communication
Course Code: 8HSMC401

L	T	P	C
2	0	0	2

Course Learning Objective:

CLO 1: To develop a general knowledge of the basic theories of human communication in rhetorical, group, and interpersonal settings.
CLO 2: To develop the basic understanding of the principles and techniques of persuasion in interpersonal, group, and public speaking contexts.
CLO 3: To develop an ability to successfully apply the above knowledge in actual small group, interviewing, business, public speaking, and interpersonal situations. The ability to write well-worded and persuasive resumes and other business communication. Also, the ability to write a valid and well-supported analysis of communication problems encountered in real-world situations.
CLO 4: To develop an understanding of how the perception of both verbal and non-verbal messages influences culture, behavior, and action of life itself.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Develop an understanding of the process of oral communication
CO 2: Develop critical thinking and analytical skills.
CO 3: Improve listening, note taking and observational skills
CO 4: Become more knowledgeable about audience centered speaking
CO 5: Develop message generating and delivery skills
CO 6: Become more knowledgeable about current speaking strategies and practices and new media research strategies

Course Content:

Topics	Hours
(Activity Based)	**24**
WORKSHOPS ➢ Debate ➢ Extempore ➢ Group Discussion ➢ Panel Discussion	

➢ Presentation-Paper & Oral ➢ Reports: Survey Report, Project Report, Case Study	

Suggested Readings:

1. *Monippally, Matthukutty. M. 2001. Business Communication Strategies. 11th Reprint. Tata McGraw-Hill. New Delhi*
2. *Swets, Paul. W. 1983. The Art of Talking So That People Will Listen: Getting Through to Family, Friends and Business Associates. Prentice Hall Press. New York*
3. *Lewis, Norman. 1991. Word Power Made Easy. Pocket Books*
4. *Sen , Leena .Communication Skills ; Eastern Economy Edition*
5. *David Green. Contemporary English Grammar, Structure & Composition ; MacMillan*
6. *Dictionary; Oxford*
7. *Dictionary ; Longman*

Websites

- *www.tatamcgrawhill.com/digital_solutions/monippally*
- *www.dictionary.cambridge.org*
- *www.wordsmith.org*
- *www.edufind.com*
- *www.english_grammar_lessons.com*
- *www.wikipedia.org/wiki/english_grammar*

Program: B.Tech
Semester: Seven
Course: Mining Project Work I
Course Code: 8PROJMiE401

L	T	P	C
0	0	3	6

Course Learning Objective:

CLO 1: To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.
CLO 2: The aim of the project is to stimulate creative and innovative aspects of their technological learning.
CLO 3: The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Mining graduates would be equipped with managerial skill which would be useful to them for achieving their program educational outputs.
CO 2: Explain the mining practices needed for current Indian coal mining scenario for sustainable development to meet organizational objective.
CO 3: Contribute towards improvement in production and productivity including optimization of manpower in mines.
CO 4: Detailed understanding of the scientific principles associated with various coal beneficiation techniques.
CO 5: Develop skill for time bound projects implementation and production commissioning with appropriate technology adoption for economic mining & effective coal beneficiation.

Any project /research work related to mining area.

JHARKHAND Rai University
RANCHI

SYLLABUS
SEMESTER VIII

B.TECH
IN
MINING ENGINEERING

2025-2029

Program: B.Tech
Semester: Eight
Course: Mine Legislation and Safety II
Course Code: 8PCCMiE404

L	T	P	C
3	0	0	3

Course Objective:

CLO 1: Enables the students to understand the organizational structure, working safety and management concepts for mining enterprises to effectively manage them within the frame work of rules and regulations.
CLO 2: Students will be acquainted with rules, laws and order for running a mine.
CLO 3: The students will have knowledge on various acts, rules and regulations relating to the mineral industry.
CLO 4: They will also know about accidents, diseases and mine safety.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Apply knowledge of legislation in mines for the implementation of rules and regulations during their job.
CO 2: Define work effectively with other engineering and science teams for suggesting any measures against any mine accidents.
CO 3: State application of various acts, rules and regulation
CO4: Interpret the cause and remedies of various accident disease and mine safety.

Course Content:

Topics	Hours
Unit 1:	**10**
Mineral Conservation & Development Rule 2017 (Amended up-to-date**):** Applicability & Definitions, Reconaissance & prospecting operations, Mining operations plans & sections, Sustainable mining, Notices & returns, Employment of mining engineers & geologists, Examination of Mineral & issue of directive , Revision & penalty, Miscellaneous & others. **Mineral Concession Rules 1960 (**Amended up-to-date**):** Important provisions regarding grant of lease, Acquisition of Land etc.	
Unit II:	**8**
Mines Rescue Rules 1985 (Amended up-to-date)- Important provisions. **Indian Electricity Rules 1961** (Amended up-to-date**):** Definitions, Important provisions regarding additional precautions to be adopted in Mines & oilfields. **Industrial Disputes Act 1947**(Amended up-to-date): Important provisions regarding strike, Lockent, Lay off, Retrenchment, Grievance Committee, Redressal Machinery, Work Board, court, Tribunals, Unfair Labour practices, Miscellaneous & other safety aspects of Mines.	
Unit III:	**6**
Mine Accident: Occupational hazards of mining; Accidents and their classification; Statistics of fatal and serious accidents; Frequency and severity rates of accidents; Place-wise and Cause-wise analysis, Henrich Triangle. Basic causes of accident occurrence; Investigations into accidents and accident reports; Measures for improving safety in mines; Cost of accidents.	
Unit IV:	**6**
Mine Safety: Introduction to safety management system and risk assessment. Analysis-safe condition- unsafe condition- mine safety- safety objectives- major factors to be considered for safety - safety week- pit safety committee- safety organization and safety policy.	

Suggested Reading:

1. *Central Government, Mines Act 1952, Lovely Prakashan, Dhanbad*
2. *Central Government, Mines Rules 1955, Lovely Prakashan, Dhanbad*
3. *Central Government, Coal Mines Regulation 1957, Lovely Prakashan, Dhanbad*
4. *Central Government, DGMS Circulars, Lovely Prakashan, Dhanbad*
5. *Ghatak, A Study of Mine Management Legislation and General Safety, Shining Printers, Asansol*

Program: B.Tech
Semester: Eight
Course: Fuel Technology and Mineral Processing
Course Code: 8PCCMiE405

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The course enables the students to select the suitable parameters and appropriate machinery for processing various types of minerals.
CLO 2: Give the students an understanding of how the basic mineral processing unit operation can be combined into specific processes.
CLO 3: Students will be acquainted with mineral separation methods – an overview, including: physical separation (gravity, magnetic and electrical); solid/liquid separation; flotation.
CLO 4: To understand the leaching process & sampling processes.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Apply knowledge of mineral dressing for understanding, formulating and solving problems related with mineral dressing.
CO 2: Acquire knowledge and hands-on competence in applying the concepts in the design and development of machines for separating the low grade ore economically.
CO 3: Design & understand the various methods for mineral beneficiation.
CO 4: Demonstrate the knowledge on leaching and laboratory sampling process.

Course Content:

Topics	Hours
Unit 1:	**8**
Fuel Technology & Solid fuels: Wood, peat, lignite, coal, anthracite; proximate and ultimate analysis; coal characteristics for different industrial uses; characteristics of Indian coals; caking and coking properties; low and high temperature carbonization. Liquid fuels: Petroleum its products and testing methods. Gaseous fuels: Natural gas, producer gas and water gas. Combustion: Combustion stoichiometry; Coal burning equipment.	
Unit II:	**8**
Mineral Processing & Introduction: Scope, objectives and limitations of mineral processing; Liberation and beneficiation characteristics of minerals and coal. Comminution: Theory and practice of crushing and grinding; Different types of crushing and grinding equipment, their application and limitations. Size separation: Laboratory size analysis and interpretation; Settling of solids in fluids; Industrial screens; Mechanical classifiers and hydrocyclones.	
Unit III:	**8**
Concentration: Gravity concentration methods: Jigging, heavy media separation, flowing film concentrator's, theory, application and limitations. Froth flotation: Physico-chemical principles; Reagents; Machines; Flotation of sulphides, oxides and coal. Electrical and magnetic methods of concentration: Principles, fields of application and limitations.	
Unit IV:	**6**
Dewatering: Thickener and filter. Hydro-metallurgical methods of recovery: Leaching- principle, various methods and applications. Laboratory sampling, Simplified flow sheets for coal, copper, lead, zinc, gold, iron, manganese ores and lime stone.	

Suggested Reading:

1. *Mineral Processing Technology by B A Wills*
2. *Introduction to Mineral Processing by E G Kelly and D J Spottiswood*
3. *Mineral Processing by S K Jain*

Program: B.Tech
Semester: Eight
Course: Fuel Technology and Mineral Processing Lab
Course Code: 8PCCMiE405P

L	T	P	C
0	0	2	1

List of Experiments:

1. Proximity analysis of coal.
2. Concentration of sulphide ore by Froth Floatation Method.
3. Study of Crushing by Jaw crusher.
4. Concentration of Magnetic ore by Magnetic separation method.
5. Study of Coal Washery.

DEPARTMENTAL ELECTIVE COURSE II
(ANY ONE OF THE FOLLOWING SUBJECTS)

Program: B.Tech
Semester: Eight
Course: Course: Mine Reclamation and Rehabilitation
Course Code: 8DECMiE406

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: The role of reclamation and closure in any mineral exploration project can be regarded as the final chapter in the life of that project.

CLO 2: At the end of the course, the student should be able to understand exploration project develops further into a feasibility study or a full-scale mining operation, however, then the reclamation process undertaken at the exploration stage becomes the first step in the final rehabilitation of the mine.

CLO 3: Learn describing reclamation and closure. These include: Decommissioning. This is the transitional period between the cessation of operations and the final closure of that operation.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Understand the post mining liabilities associated with mines.

CO 2: Know the technical aspects to mitigate the adverse impacts.

CO 3: Estimate the financial liability associated with a mining project.

CO 4: Understand objective of rehabilitating a typical exploration site is to minimize long-term environmental liability by maintaining geotechnical stability, restoring native ecosystems, striving to achieve a more beneficial land use, etc.

Course Content:

Topics	Hours
Unit 1:	**6**
Economical and technical aspects of reclamation of mined out land. Reclamation Methods: Back filling, outside dumps and their stability.	
Unit II:	**8**
Top soil handling, assessment of soil productivity potential, re-vegetation, factors for plant Growth, parameters for soil quality and their importance. Reclamation plan and land use plan, general requirements of protection of hydrologic balance.	
Unit III:	**8**
Erosion of soil: types of erosion, estimation of top soil erosion, Landscaping of disturbed and, estimation of reclamation cost and benefits, use of reclaimed land and structures.	
Unit IV:	**8**
Mine Closure Planning: Importance, methodology, statutes concerning mine closure, Land reclamation as post mining operation, Statutes concerning reclamation of mined out area. Mine rehabilitation: Planning, Principles of Rehabilitation, Standard Rehabilitation, Monitoring, Maintenance and Relinquishment of Restored Mines.	

Suggested Reading:

1. Surface Mining Technology, S.K. Das

2. Elements of Mining Technology Vol I, D.J. Deshmukh

3. Bio-Geotechnologies for Mine Site Rehabilitation, M.N.V. Prasad, Paulo Jorge deCampos Favas, Subodh Kumar Maiti

4. Spoil to Soil: Mine Site Rehabilitation and Revegetation. 1st Edition, by N.S. Bolan,M.B. Kirkham, Y.S. Ok

Program: B.Tech
Semester: Eight
Course: Clean Coal Technology
Course Code: 8DECMiE407

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: After completion of this course student will be aware of alternate fossil fuels, their production methods.
CLO 2: Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Explain technology & process for coal bed methane exploration.
CO 2: Analyze the CBM reservoir & methane estimation.
CO 3: Understand the concept of hydraulic fracturing in coal bed.
CO 4: Interpret the method of compression & transportation in CBM.

Course Content:

Topics	Hours
Unit 1:	**8**
Introduction to clean coal technology: Coal quality parameters for utilization in thermal power plant, cement, steel and DRI plant. Pre combustion cleaning, during combustion cleaning, post-combustion cleaning, burning time, unburned carbon estimation and control. Biological and chemical cleaning methods.	
Unit II:	**8**
Emission control: Fly ash, SOx and NOx control strategies during combustion and after combustion. Use of ESP, Cyclones, Filters and settling chambers. CO2 sequestration.	
Unit III:	**8**
Coal gasification: Gasifying agents: oxygen, air, steam, reactions involved in gasification. Effect of fuel properties on product, blending of fuels. Syn gas, Fuel gas. Types of gasifiers: Fixed bed, moving bed, fluidized bed, entrained bed etc. Product gas cleaning and energy utilization, removal of H2S, NH3, tar, suspended particulate matter.	
Unit IV:	**6**
Other technologies: Underground coal gasification (UCG), Coal bed methane, recovery of methane from CBM (Coal Bed Methane), CMM (Coal Mine Methane), AMM (Abandoned Mine Methane), combined cycle power generation (IGCC), oxy-fuel combustion.	

Suggested Reading:

1. *Fuels and Combustion, Samir Sarkar, Universities Press*
2. *The Chemistry and Technology of Coal, James P. Speight, CRC Press*
3. *Clean Coal Engineering Technology, Bruce Miller, Butterworth Heinemann*

Program: B.Tech
Semester: Eight
Course: Coal Bed Methane Mining
Course Code: 8DECMiE408

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: After completion of this course student will be aware of alternate fossil fuels, their production methods.
CLO 2: Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Explain technology & process for coal bed methane exploration.
CO 2: Analyze the CBM reservoir & methane estimation.
CO 3: Understand the concept of hydraulic fracturing in coal bed.
CO 4: Interpret the method of compression & transportation in CBM.

Course Content:

Topics	Hours
Unit 1:	**8**
Coalification process and coal grades. Methane generation and storage in coal; Geological control in Coal Bed Methane (CBM) exploration; Methane adsorption, desorption in coal.	
Unit II:	**8**
Coal as CBM reservoir: In-place methane estimation; Transport of methane in coal-bed. Drilling& Completion of a CBM hole/well. Identification and characterization of coal beds by hole/ well logs.	
Unit III:	**8**
Hydraulic fracturing in coal beds. Production performance of a CBM hole/well; Water drainage &gas-water separation. Gas volume measurement.	
Unit IV:	**6**
Compression &transport; Liquefaction and utilization. Enhanced recovery by CO2 and N2 adsorption methods.	

Suggested Reading:

4. *Progressive Technologies of Coal, Coal bed Methane, and Ores Mining by Volodymyr Bondarenko, Iryna Kovalevs'ka*
5. *Advanced Reservoir and Production Engineering for Coal Bed Methane by Pramod Thakur*
6. *Fundamentals of Coal bed Methane Reservoir Engineering by John Seidle*

Program: B.Tech
Semester: Eight
Course: Socio Economic Impacts of Opencast Mines
Course Code: 8DECMiE409

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: Upon completion of this course, the students can able to outlines various factors which effects the ecological and societal imbalance, repercussions due to mega open cast mining projects.
CLO 2: Upon completion of this course, the students can able to identify Environmental and social impacts are divided into waste management issues, impacts to biodiversity and habitat, indirect impacts, and poverty alleviation and wealth distribution.
CLO 3: Upon completion of this course, the students can able to summarize those environmental and social issues that formed the basis for the Mining and Critical Ecosystems framework.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Know to environmental problems in mines and present environmental scenario, Techno-economics of environmental management.
CO 2: Know the Environmental Impact Assessment.
CO 3: Understand the Environmental Management Plan.
CO 4: Understand the Land Acquisition & Revenue & Related laws and regulations.

Course Content:

Topics	Hours
Unit 1:	**10**
Introduction: History of environmental problems in mines and present environmental scenario, Techno-economics of environmental management. Environmental Parameters and Standards: Baseline data. Impact of mining activities on environmental parameters, Mitigating measures, monitoring and control, National and international standards and regulations. ISO principles and series.	
Unit II:	**8**
Environmental Standards: National and International standards of various environmental parameters, Environmental Impact Assessment (EIA): Framework for EIA, screening, scoping and baseline studies. EIA methodologies and their applicability, Environmental & Impact Indices, uncertainties in EIA.	
Unit III:	**6**
Environmental Management Plan (EMP):Scope, structure and legislative requirements. Preparation of EMP.	
Unit IV:	**6**
Land Acquisition & Revenue: Concepts, Related laws and regulations. Corporate Social Responsibility: Concepts and principles. Mine closure: Concepts and principles. Environmental administration: Laws related to mining environment.	

Suggested Reading:

1. *Environmental Legislation in India, Region Asia.*
2. *Pollution control acts, rules and notifications issued thereunder, CPCB-India*
3. *Environmental Law of India, S.K. Choudhury, Oxford & IBH Publishers.*
4. *Handbook of Environmental laws, Acts, Guidelines, Compliances & Standards Policy, Trivedy, BS Publishers.*

Program: B.Tech
Semester: Eight
Course: Sustainable Mining Practices
Course Code: 8DECMiE410

L	T	P	C
3	0	0	3

Course Learning Objective:

CLO 1: After completion of this course student will be able to move towards sustainability by developing a range of appropriate stewardship initiatives.
CLO 2: Upon completion of this course, the students can able to identify economic development, environmental impact and social responsibilities must be well managed, and productive relationships must exist between government, non-government organisations, industry and stakeholders.
CLO 3: The Strategy for incorporating involved in extracting non-renewable resources have come under increasing pressure to embed the concept of sustainability into strategic decision-making processes and operations.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Environmental problems associated with the coal preparation plants.
CO 2: The mitigating measures associated with those issues.
CO 3: Regulatory frameworks associated with those issues.
CO 4: Know environment impacts related with coal preparation plants and throw the light into regulatory frameworks related with these plants.

Course Content:

Topics	Hours
Unit 1:	**8**
Coal preparation and washing: The Needs of Coal Preparation, Coal preparation process –physical, chemical or mechanical processes, Coal dust generation: Sources, characterization, ill effects, measurement, monitoring, standards, mitigating measures.	
Unit II:	**8**
Air pollution: Sources, characterization, ill effects, measurement, monitoring, standards, mitigating measure. Water pollution: Sources, ill effects, water quality parameters–physico-chemical, biological and bacteriological. Water quality criteria, standards, monitoring and mitigating measures. Heavy metal pollution and its abatement; Surface water pollution – detection and management.	
Unit III:	**8**
Environmental Impact Assessment: Methods of EIA and their applicability.	
Unit IV:	**6**
Environmental Management Plan: Structure and preparation of EMP, Environmental Laws.	

Suggested Reading:

1. *Elements of Fuel technology, Godfrey Wilfred Himus, Leonard Hill Limited. 1958.*
2. *Fuels: Solid, liquid and gaseous fuels, J. Brame and King, Kessinger Publishing, LLC,2007.*
3. *Coal, Oil Shale, Natural Bitumen, Heavy Oil and Peat - Volume I, Gao Jinsheng – 2009*

Program: B.Tech
Semester: Eight
Course: Mining project Work II
Course Code: 8PROJMiE402

L	T	P	C
0	0	6	6

Course Learning Objective:

CLO 1: To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.
CLO 2: The aim of the project is to stimulate creative and innovative aspects of their technological learning.
CLO 3: The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

Course Outcome:

On the completion of the Course, the students will be able to:
CO 1: Mining graduates would be equipped with managerial skill which would be useful to them for achieving their program educational outputs.
CO 2: Explain the mining practices needed for current Indian coal mining scenario for sustainable development to meet organizational objective.
CO 3: Contribute towards improvement in production and productivity including optimization of manpower in mines.
CO 4: Detailed understanding of the scientific principles associated with various coal beneficiation techniques.
CO 5: Develop skill for time bound projects implementation and production commissioning with appropriate technology adoption for economic mining & effective coal beneficiation.

Any project /research work related to mining area.