B. Tech (Mining) V SEMISTER

S. No	Course Code	Course Title	Scheme of Instruction			Lecture hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	PC3101MN	Rock Mechanics	3	1	-	4	30	70	4
2	PC3102MN	Underground Mining Methods (Coal)	3	1	-	4	30	70	4
3	PC3103MN	Mine Hazards and Rescue	3	1	-	4	30	70	4
4	PC3104MN	Mining Machinery	3	-	-	3	30	70	3
5	PC3105MN	Mining Instrumentation and Automation	2	-	-	2	30	70	2
6	PC3106MN	Rock Mechanics Laboratory	-	-	3	3	25	50	1.5
7	PC3107MN	Mine Hazards and Rescue Laboratory	-	-	3	3	25	50	1.5
8	PC3108MN	Internship – I (Underground Coal Mining)	-	-	-	-	100	-	1
9	MC3101CE	Strength of Materials	-	-	-	-	-	-	-
Total			**14**	**3**	**6**	**23**	**300**	**450**	**21**

- The Internship – I taken during summer vacation after IV Semester
- The students have to complete MC3101CE using any one of the MOOC platform and produce the certificate.

B Tech (Mining) V- Semester

PC3101MN

ROCK MECHANICS

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	1	0	4	External Marks : 70

UNIT I

Physico-mechanical properties of rocks:

Physical properties: Density, porosity, void ratio, moisture content, permeability. Mechanical Properties: Preparation of rock samples, determination of mechanical properties of rocks: compressive strength, tensile strength, shear strength, modulus of elasticity, poisson's ratio, cohesion, angle of internal friction, Protodyaknov`s strength index, longitudinal wave velocity, rock burst ability index, Schmidt rebound hardness number, slake durability index.

UNIT II

Rock mass classification:

Core recovery, Rock quality designation, Rock mass rating, Indian- geo mechanics classification, Q System, Geological strength index, Slope mass rating, rippability classification, Coal mine roof rating,

UNIT III

Stress strain analysis:

Analysis of stress and strain in two and three dimensions, Principal stress, stress ellipsoid, Determination of principal stress and strain invariants; Differential equilibrium equations; compatibility equation of stress and strains, Stress and strain transformation, Mohr's circle of stress and strain, Plane stress and plane strain condition.

UNIT IV

Rock mass behavior:

Confining pressures, effect of water, time, temperature. Insitu stress and their estimation; flat jack method, over coring method and hydro fracturing method; Horizontal and vertical stress, intact rock strength and deformability; measuring devices for load, stress and strain. Dynamic loading of rocks
Time dependent properties of rock, creep, mechanism of creep of rocks – different stages, rheological models

UNIT V

Rock failure theories:

Coulomb, Mohr's – Coulomb, Hoek and Brown, Griffiths and Drucker – Prager and Its related calculations

Text / Reference books:

1. Deb D and Verma AK, “Fundamental and application of rock mechanics”,. PHI publication
2. Debasis Deb, “Finite elemnt method: concepts and application in geo mechanics”
3. SP Timoshenko, JN. Goodier, “Theory of Elasticity”
4. V Singh and B P Khare, “Rock Mechanics and ground control”
5. Obert and Duvall, “Rock Mechanics and design of structures in rock”
6. Jumikis, “Rock Mechanics”
7. Goodman, “introduction to Rock Mechanics”
8. Binawiski ZT, “Engineering rock mass classification”
9. Singh & goel, “ Rock mass classification”

B Tech (Mining) V- Semester

PC3102MN

UNDERGROUND MINING METHODS (COAL)

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	1	0	4	External Marks : 70

UNIT I

Introduction:

Access to coal deposits; shafts, incline. Factors affecting choice of mining method; Classification of mining methods; Status of coal mining industry, grading and analysis of coal

UNIT II

Development of Deposit:

Division of the mining property into panels, working districts and working places. Development of panels for bord and pillar, Longwall, shortwall etc., with conventional and continuous mining techniques Factors affecting the selection of equipment

UNIT III

Methods of Pillar Extraction:

Preparatory arrangements for development & depillaring operation, principle and design of depillaring. Factors affecting choice of pillar extraction. Different methods of pillar extraction including continuous miner technology, Wongwalli, Shortwall and continuous seam working

UNIT IV

Longwall Methods:

Advance and retreat methods, continuous and cyclic systems, extraction with different machines – ploughs, shearers, design of Longwall workings, optimum length of face, size of panel, gates, support system, personnel, organization and safety measures, face equipment installation, salvaging operation.

UNIT V

Special Mining Methods:

Slice Mining, Sub Level caving, integrated sub level caving, blasting gallery method, Longwall mining with top coal caving (LTCC), Horizon mining, problems of working thick and thin seams liable to spontaneous heating, outburst and bumps, Highwall mining, punch entries.

Text / Reference books:

1. Mathur SP, “Coal Mining in India”, Sahyog Prakashan, Chattisgarh
2. Singh JG, “Underground Coal Mining Method”. Braj Kalpa Publishers, Varanasi
3. Samir kumar Das,” Modern Coal Mining Technology”. Lovely Prakashan, Dhanbad
4. Vorobjev BM & Deshmukh RT,, “Advance Coal mining Vol – I & II”
5. Woodroof CD, “Methods of working coal and metal mines” Vol - III

B Tech (Mining) V- Semester

PC3103MN

MINE HAZARDS & RESCUE

Teaching Scheme				Examination Scheme
L	**T**	**P**	**C**	**Internal Marks: 30**
3	**1**	**0**	**4**	**External Marks : 70**

UNIT I

Mine fires:

Classification, surface and underground fires, causes and effect of mine fires, spontaneous combustion, causes and nature of spontaneous combustion, its detection and prevention. Firefighting equipment: selection installation, operation and maintenance in mines. fire fighting organization, sealing of fire areas, re-opening of sealed off areas

UNIT II

Explosions:

Classification of explosions, causes of underground explosions, Fire damp explosions: causes and preventive measures, Coal dust explosions, Explosibilty of coal dust, causes and preventive measures to be taken against coal dust explosions, water gas explosion.

UNIT III

Inundation:

Causes of mine inundations from surface and underground sources, precautionary and productive measures on surface and in underground, Approaching water logged areas and dewatering of water logged areas. Design of various water dams, sump and pumps.

UNIT IV

Rescue and recovery work:

Mine rescue and first aid equipment, short distance apparatus, self contained oxygen breathing apparatus, self rescuers, reviving apparatus, rescue stations, organization, rescue and recovery work in connection with fires, explosions and inundations. Basic principles of risk management. Dust in mine air: dust production in mines and its control, health hazards, sampling and assessment of airborne dust.

UNIT V

Mine illumination:

Standards of illumination, common types of flame safety lamps, their use and limitations, electric hand and cap lamp, their maintenance and examination, lamp room design and organization. Illumination arrangements of opencast and underground workings

Text / Reference books:

1. Ramulu MA, “Mine Fires explosions, rescue, recovery and illuminations”,
2. Kaku, “Fires in coal mines”.
3. DJ Deshmukh ,” Elements of Mining Technology” Vol. -II

B Tech (Mining) V- Semester

PC3104MN

MINING MACHINERY

Teaching Scheme				Examination Scheme
L	**T**	**P**	**C**	**Internal Marks: 30**
3	**0**	**0**	**3**	**External Marks : 70**

UNIT I

Introduction:

Elements of mine transport and material handling system: Classification and techno- economic indices, types of motive power used in mines.

Wire Rope: classification, construction details , selection of rope , factor of safety, rope capping and splicing; deterioration of rope in use and its prevention; testing of ropes, selection and maintenance, rope calculations.

UNIT II

Rope haulage:

Construction of rope haulages–gravity, direct, balanced direct, main & tail, endless, reversible endless. Suitability of these haulages and their limitations. Dimension of ropes, drums and pulleys, care and maintenance of ropes, changing of haulage ropes, safety appliances in haulage road, statutory requirements of haulages.

UNIT III

Winding:

Winding systems, drum winders, drives, mechanical braking of winders, safety devices in winding, overwind and over speed protection, Koepe and multi-rope friction winding. Calculations relating to rope size & numbers, capacity & power requirement for cages, skips, drum and Koepe winding systems

UNIT IV

Head gear & Mine Pumps:

Head gear and their design, head sheave, cages and skips, suspension gear, shaft fittings and appliances guides, keps, etc., signalling systems.

Pump and sump design in opencast and underground mines, different types of pumps, their construction and application. Mine pump calculations. Safety boring apparatus

UNIT V

Mine Signaling and Compressors:

Methods, signaling system in winding system, haulage roads, Longwall faces, operation of underground and opencast mines telephone. Compressors: types of compressors, different stages in compression, compressors used for bolting, location of compressors, laying of air hose in the panel

Text / Reference books:

1. Karelin, “Mine Transport”.
2. DJ Deshmukh ,” Elements of Mining Technology” Vol. -III
3. Rakesh and Lele ,” Selection and installation of mine pumps”
4. Hartmen ,” Introduction to Mining Engineering”
5. Statham ,” Coal Mining Practice”

B Tech (Mining) V- Semester

PC3105MN

MINING INSTRUMENTATION AND AUTOMATION

Teaching Scheme				Examination Scheme
L	**T**	**P**	**C**	**Internal Marks: 30**
2	**0**	**0**	**2**	**External Marks : 70**

UNIT I

Introduction to rock mechanics instrumentation. Various types of deformation devices, strain gauges, LVDT's. Load cells, convergence recorders, Telltale, borehole extensometers.

UNIT II

Introduction to Ultrasonic sensors and monitors, geophones, seismographs, electro-magnetic velocity meters, accelerometers, high speed video cameras, laser profilers.

UNIT III

Field instrumentation in bord& pillar, blasting gallery, longwall and highwall mining; Remote Convergence Monitoring Systems, Remote monitoring and operation of mining equipment using telemonitoring and modern devices

Automation in monitoring of environments in longwall and continuous mining system

UNIT IV

Rock slope monitoring instruments: incline meters, tilt meters. Crack meters, total station, LiDAR, Slope stability radar, Bore hole radars

Development of smart drilling machines and their utilization in drilling and exploration for improving performance

UNIT V

Automation and robotic: Development of robotic systems, different types and possible applications in mine safety.

IOT and Adaptive Wireless Sensor Networks (AWSN) and their applications in mineral industry

Text / Reference books:

1. Hustrulid, “Underground Mining Methods Handbook” SME NY, 1994
2. Society of Mining Engineering Handbooks –Vol. I and II
3. Peng, S.S.,” Longwall Mining “,John Willey and Sons
4. Ervin, M.C., Insitu testing for geotechnical investigations, A. A. Balkema, 1983.
5. Hunt, R.E., “Geotechnical Engineering investigation manual”, CRC Press, 2005
6. R. Ulusay, “The ISRM Suggested Methods for Rock Characterization, Testing and Monitoring”, 2007-2014, Springer, 2016.
7. Ian F. Akyildiz, “Wireless Sensor Networks”, A John Wiley and Sons, Ltd, Publication
8. David J. Daniels, “Ground penetrating radar”, Institution of Engineering and Technology, 2004

B Tech (Mining) V- Semester

PC3106MN

ROCK MECHANICS LABORATORY

Teaching Scheme				Examination Scheme
L	**T**	**P**	**C**	**Internal Marks: 25**
0	**0**	**3**	**1.5**	**External Marks : 50**

1. Sample Collection and Specimen preparation
2. Determination of moisture content, density, void ratio and porosity of rocks
3. Determination of compressive strength, modulus of elasticity and poisson`s ratio of rocks
4. Determination of tensile strength of rocks
5. Determination of shear strength, angle of internal friction and cohesion of rock
6. Determination of point load strength index of rocks
7. Determination of Protodyaknov strength index of rocks
8. Determination of slake durability index of rocks
9. Determination of hardness of rocks.
10. Determination of losangles index
11. study of convergence measuring instruments
12. Testing props, chocks etc.,

B Tech (Mining) V- Semester

PC3107MN

MINE HAZARDS AND RESCUE LABORATORY

Teaching Scheme				Examination Scheme
L	**T**	**P**	**C**	**Internal Marks: 25**
0	**0**	**3**	**1.5**	**External Marks : 50**

1. Study of fire extinguishers
2. Determination of ignition point and explosibility of coal dust
3. Determination of crossing point temperature
4. Study of stone dust and water barriers
5. Various types of stopings
6. Self contained breathing apparatus
7. Self rescuers, gas masks, smoke helmet
8. Reviving apparatus
9. Reopening of sealed off area
10. Konimeter, gravimetric dust sampler and personal dust sampler