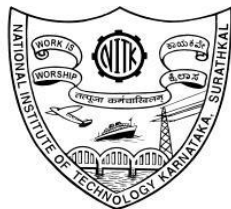


**B. Tech.**

**COURSE OUTCOME AND EVALUATION PLAN  
(2019 – 2020)**



**DEPARTMENT OF MINING ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL**

**KARNATAKA – 575014, INDIA**

## B.TECH. (II SEMESTER)

1. **Course Code** : MI101
2. **Course Title** : **Introduction to Mining Engineering**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Anup K. Tripathi**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of unit operations in mining, different mining methods, environmental impacts of mining and mine safety aspects

### 9. Skill development of the student expected from the course:

After the completion of the course, student is expected to have skills in:

- CO1. Understanding of different unit operations in mining.
- CO2. Understanding of environmental impacts of mining and their remediation.
- CO3. Understanding of different mining methods used for metallic and non-metallic mineral extraction.
- CO4. Understanding of mine safety aspects.

### 10. Course Plan: 34hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Introduction to Indian Mining Industry, National and International Scenario	4	Deshmukh, D. J., Elements of Mining Technology, Vol. I, 1994  Hartman H.L., Introductory Mining Engineering, Wiley Interscience, New York, 1987.  Mishra, G.B, Surface Mining Dhanbad Publishers, Dhanbad, 1994.
2	Unit Operations - Drilling	3	
3	Unit Operations - Blasting, Excavation	5	
4	Unit Operations - Transportation	4	
5	Unit Operations - Size reduction	3	
6	Introduction to Mining Methods	8	
7	Environmental Impacts	4	
8	Safety	3	
<b>Total</b>		<b>34</b>	

### 11. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (III SEMESTER)

1. **Course Code** : MI201
2. **Course Title** : **Development of Mineral Deposits**
3. **L-T-P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. A. K. Tripathi and Dr. B. M. Kunar**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of development of mineral deposits, methods of shaft sinking and drivage of horizontal openings, and support systems for vertical and horizontal development underground.

### 9. Course outcomes:

After the completion of the course, student is expected to have skills in:

- CO1: Understanding various methods of shaft sinking,
- CO2: Understanding various raising methods for vertical development,
- CO3: Understanding drivage of horizontal openings and tunnelling,
- CO4: Understanding different supports used for roadways and mine faces.

### 10. Course Plan: 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Methods of shaft construction; widening and deepening of shafts.	8	Tatiya, R. R., Surface and Underground Excavations, A. A. Balkema Publishers.
2	Special methods of shaft sinking under difficult conditions.	4	Deshmukh, D. J., Elements of Mining Technology, Vol. I, 1994.
3	Methods of raising.	8	
4	Drivage of horizontal openings; tunnelling under difficult conditions.	10	Onika, D., Design of Mine Excavations, Mir Publishers, Moscow.
5	Supports for supporting roadways and mine faces.	10	Pokrovsky, N. M., Driving of Horizontal Workings and Tunnels, Mir Publishers, Moscow.
<b>Total</b>		<b>40</b>	

11. **Details on Tutorials** : At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

### 12. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (III SEMESTER)

1. **Course code** : MI202
2. **Course Title** : **Mine Surveying**
3. **L-T-P** : 3-1-0
4. **Credits** : 04
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. M. Aruna & Prof. Ch. S. N. Murthy**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To impart the knowledge to the students
  - About the various surveying instruments
  - About the various surveying methods like compass survey, theodolite survey, leveling etc.,
  - About the areas and volumes calculations
  - About the dip, fault and borehole problems

### 9. **Course outcomes:**

After the completion of the course student is expected to have skill in:

CO1: Using various surveying instruments

CO2: Various surveying methods

CO3: Preparation of mine plans and sections

CO4: Various earth work calculations

### 10. **Course Plan:** 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Principle of Mine Surveying	4	Punmia, Surveying Vol- I & II  Kanetkar, Surveying, Vol – I & II  Ghatak, Mine surveying, Vol- I, II, III
2	Compass surveying	5	
3	Calculation of areas and volumes	4	
4	Dip, fault and borehole problems	4	
5	Levelling	5	
6	Theodolite survey, Traversing	5	
7	Balancing of traverse	4	
8	Calculation of coordinates and plotting	4	
9	Contouring and interpolation of contours	5	
<b>Total</b>		<b>40</b>	

### 11. **Details on Tutorials** : One hour per week

### 12. **Evaluation Plan:**

- a. Continuous evaluation: :25%  
(Slip tests/Quiz + Assignment)
- b. Mid Semester Performance: :25%
- c. End Semester Performance: :50%

## B.TECH. (III SEMESTER)

1. **Course code** : MI203
2. **Course Title** : **Mine Surveying Laboratory**
3. **L-T-P** : 0-0-3
4. **Credits** : 02
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. B. M. Kunar and Dr. M. Aruna**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To impart the knowledge to the students about the various surveying instruments and various surveying methods in plane surveying.

### 9. Course outcomes:

CO1: At the end of the course, the student is expected to know the application of each experiment and be able to apply mine surveying method using suitable apparatus/ equipment.

### 10. Course Plan:

#### List of Experiments

Sl. No.	Title of Experiment	No. of Lab Classes
1.	Measurement of horizontal angles in a closed traverse using Prismatic Compass	1
2.	Measurement of Horizontal angles in a closed traverse using Surveyor's Compass	1
3.	Determination of level difference by Rise and Fall Method	1
4.	Determination of Level difference by Height of Instrument Method	1
5.	Measurement of Horizontal angles using theodolite	1
6.	Measurement of vertical angles using theodolite	1
7.	Measurement of horizontal and vertical angles using theodolite by Repetition Method	1
8.	Measurement of horizontal and vertical angles using theodolite by Reiteration Method	1
9.	Plotting the area by selecting suitable stations using theodolite	1
10.	Plotting of the objects in the field of surveying using theodolite	1
11.	Contour surveying using Dumpy Level	1
<b>Total</b>		<b>11</b>

### 11. Evaluation Plan:

- a. Drawing sheet evaluation : 40%
- b. End semester performance : 60%

## B.TECH. (III SEMESTER)

1. **Course Code** : MI210
2. **Course Title** : **Drilling & Blasting Engineering**
3. **L-T-P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructors** : **Prof. M. Govinda Raj & Dr. K. Ram Chandar**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To make aware of the student:
  - Importance and applications of Drilling & Blasting in Mining Industry
  - Classification and mechanism of rock drilling methods
  - Various drilling machines and their applications
  - Alignment and deviations of boreholes
  - Different types of explosives and their properties
  - Different initiating devices
  - Exploders and circuit testers
  - Safety aspects in blasting

### 9. Course outcomes

At the end of the course, the student is expected to have skills in

CO1: Identifying the different drilling machines, their mechanism and applications

CO2: Different drilling methods

CO3: Different explosives and their properties and applications

CO4: Different initiating devices and their applications

CO5: Various safety aspects to be followed in Drilling

CO6: Safety aspects to be followed while handling explosives

### 10. Course Plan: 45 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Applications of drilling in mining, classification of drilling methods, mechanisms of rock drilling	8	Principles of rock drilling: K.U.M Rao Blasting safety manual: G.K. Pradahn & M.S. Sandhu Elements of Mining technology, Vol-I: D.J. Deshmukh
2	Factors influencing percussive and rotary drilling. Different types of drill machines, alignment and deviation of boreholes	8	
3	Drilling for exploration, production drilling and drill patterns	4	
4	Developments in explosives, classification and properties of explosives	8	
5	Developments in initiating devices	6	
6	Storage and handling of explosives, safety aspects in blasting	4	
7	Exploders, circuit testers	3	
8	Blasting methods and layouts	4	
<b>Total</b>		<b>45</b>	

11. **Details on Tutorials** : 1 Hour tutorial per week

### 12. Evaluation Plan:

- a. Continuous Evaluation :25%  
(slip test, quiz, assignments etc.)
- b. Mid Semester Performance :25%
- c. End Semester Performance :50%

## B.TECH. (IV SEMESTER)

1. **Course code** : MI251  
2. **Course title** : **Mine Environment & Ventilation Engineering**  
3. **L – T – P** : 3-1-0  
4. **Credits** : 4  
5. **Prerequisite** : Nil  
6. **Course instructor** : **Dr. Harsha Vardhan**  
7. **Teaching Department** : Mining Engineering  
8. **Objective of the Course:** This course provides knowledge on ventilation and its control in underground mines to meet statutory requirements, removal of contaminants and for comfortable working conditions for the underground miners.

### 9. Course outcomes:

After the completion of the course, the student is expected to know about:

- CO1: Ventilation planning for an underground mine  
CO2: Details of different types of mechanical ventilators and ventilation system  
CO3: Design a ventilation system for a given set of conditions for a mine

### 10. Course Plan: 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	Mine gases: hazards, occurrence, detection, monitoring and control.	05	An Introduction to Underground Mine Environment and Ventilation by Dr. Harsha Vardhan available online at NPTEL website
2.	Methane: properties, detection, drainage techniques.	03	
3.	Mine illumination: methods, design, standards, effects of low illumination.	02	
4.	Heat and humidity: Sources, effects, estimation	06	
5.	Mine air conditioning	02	
6.	Psychrometry	01	
7.	Natural ventilation: factors influencing and estimation	04	
8.	Airflow in mines: airflow, resistance to air flow from mine workings and distribution of mine air.	05	
9.	Mechanical ventilation: fans and their operation, auxiliary ventilation.	05	
10.	Fan laws	01	
11.	Network analysis: airflow requirements based on pollutant gas, heat and humidity.	03	
12.	Ventilation surveys	03	
<b>Total</b>		<b>40</b>	Mine Environment and Ventilation by G.B.Mishra  Environmental Engineering in Mines by V.S.Vutukuri and R.D.Lama

11. **Details on tutorials:** At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

### 12. Evaluation plan:

- a. Continuous evaluation :25 %  
b. Mid-Term examination :25 %  
c. End-Term examination :50 %

## B.TECH. (IV SEMESTER)

1. **Course Code** : MI252
2. **Course Title** : **Mine Environmental Engineering – I Laboratory**
3. **L-T-P** : 0-0-3
4. **Credits** : 2
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. Anup Kumar Tripathi and Prof. Harsha Vardhan**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To impart the knowledge to the students about the mine ventilation systems and underground mine environment monitoring devices

### 9. Course outcomes:

CO1: At the end of the course, the student is expected to know the application of each experiment and be able to do required mine ventilation system study using suitable apparatus/ equipment.

### 10. Course Plan:

#### List of Experiments

Sl. No.	Title of Experiment	No. of Lab Classes
1	To determine the air velocity and air quantity in a given cross-sectional area using Vane Anemometer and Digital Anemometer, and compare the results.	1
2	To determine the relative humidity at a given location using Whirling Hygrometer and Asman Psychrometer and compare the results obtained using Psychrometric Chart.	1
3	To determine the concentration of different gases using multi-gas detector and MSA Carbon Monoxide detector at a given location.	1
4	To determine the air velocity and quantity at given points in the duct using Pitot Static Tube with the Centrifugal fan running at given RPM.	1
5	To determine the resistance and K-factor between any two given points in the ventilation duct provided with Centrifugal fan and Axial flow fan.	1
6	To determine the shock loss factor for a right-angled bend in a ventilation duct with the Centrifugal fan running at given RPM.	1
7	To determine the shock loss factor for a U-turn bend in a ventilation duct with the Axial flow fan running at given RPM.	1
8	To verify the law of resistances of a system of ducts connected in series.	1
9	Principle of operation and use of different types of fire extinguishers.	1
10	To draw the characteristic curves of a backward bladed Centrifugal fan.	1
11	To draw the characteristic curves of an Axial flow fan.	1
12	To study the characteristic features of a flame safety lamp and the procedure to carry out accumulation and percentage test in the Gas Testing Chamber.	1
<b>Total</b>		<b>12</b>

### 11. Evaluation Plan:

- a. Continuous evaluation : 60%
- b. End semester performance : 40%



## B.TECH. (III SEMESTER)

1. **Course code** : MI253
2. **Course Title** : **Applied Mine Surveying Laboratory**
3. **L-T-P** : 0-0-3
4. **Credits** : 02
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. B. M. Kunar & Prof. Ch. S. N. Murthy**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To impart the knowledge to the students about the various advanced surveying instruments and surveying methods in Engineering surveying.

### 9. Course outcomes:

CO1: At the end of the course, the student is expected to know the application of each experiment and be able to do apply mine surveying method using suitable apparatus/ equipment.

### 10. Course Plan:

#### List of Experiments

Sl. No.	Title of Experiment	No. of Lab Classes
1.	Determine of K and C constants of a given tacheometer	1
2.	Determination of Horizontal and vertical distance between two points using tacheometer by Stadia Hair method, when the two points are at different elevations	1
3.	Determination of horizontal and vertical distance between two points using tacheometer by tangential method, when the two points are at different angles of elevation	1
4.	Setting the simple circular curve using the method of co-ordinates or offsets from long chord	1
5.	Setting the simple circular curve using the method of Perpendicular offsets from the tangent	1
6.	Connection of underground and surface survey using Weibach Triangle method	1
7.	Connection of underground and surface survey using Co-plannar method	1
8.	Plotting of RL and co –ordinates of different points obtained by Total station using SURPAC Software	1
9.	Determination of RL and co-ordinates of different points using GPS	1
10.	Plotting of RL and co- ordinates from different points obtained by GPS using SURPAC software	1
11.	Plotting of RL of different points obtained from Autolevel by using Microsoft Excel	1
<b>Total</b>		<b>11</b>

### 11. Evaluation Plan:

- a. Drawing sheet evaluation : 40%
- b. End semester performance : 60%

## B.TECH. (IV SEMESTER)

1. **Course Code** : MI260
2. **Course Title** : **Applied Mine Surveying**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Prof. M. Govinda Raj & Dr. M. Aruna**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To impart the knowledge to the students
  - a. About the various surveying instruments
  - b. About the various surveying methods like tacheometric surveying, curve ranging, triangulation, correlation survey etc.,
  - c. About the modern instruments in surveying

### 9. Course outcomes:

After the completion of the course student is expected to have skills in:

CO1: Using various surveying instruments

CO2: Various surveying methods

CO3: Handling of Total Station and Digital theodolites

### 10. Course Plan: 32 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Basic principle of triangulation survey	2	Punmia, Surveying Vol - I, II & III  Kanetkar, Surveying, Vol – I, II & III  Ghatak, Mine surveying, Vol - I, II, III
2	Signals, towers and satellite station	3	
3	Different methods of tacheometry surveying	4	
4	Methods of curve ranging	4	
5	Laying of curves in underground	4	
6	Aerial photogrammetry and field astronomy	4	
7	Correlation survey	4	
8	Electronic Distance Measurements	3	
9	Introduction to terrestrial laser scanner and drone surveying	4	
<b>Total</b>		<b>32</b>	

11. **Details on Tutorials** : One hour per week.

### 11. Evaluation Plan

- a. Continuous evaluation :25%  
(Slip test/Quiz + assignments)
- b. Mid semester performance :25%
- c. End semester performance :50%

## B.TECH. (III SEMESTER)

1. **Course Code** : MI254
2. **Course Title** : Mining Machinery
3. **L-T-P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructors** : Dr. Anup K. Tripathi and Dr. B. M. Kunar
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of different types of mining equipment used in underground and surface mines.

### 9. Course outcomes:

After the completion of the course, student is expected to have skills in:

- CO1. Understanding various types of transportation equipment used underground.
- CO2. Understanding motive power used in mines including compressed air power.
- CO3. Construction, maintenance, capping and splicing of wire ropes.
- CO4. Understanding drum and Koepe winding systems, their suspension gear and braking arrangements.
- CO5. Types of drainage and pumps used in mines.

### 10. Course Plan: 42 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Basic principles of transport of men, materials and mineral in underground mines.	4	Ramlu, M. A., Mine Hoisting, Oxford and IBH, New Delhi, 1996
2	Techno-economic indices of transportation systems.	2	
3	Pit-top and pit-bottom layouts; motive power used in mines; man riding systems.	6	
4	Types of compressors used in mines.	4	Walker, S. C., Mine Winding and Transport, Elsevier, Amsterdam, 1988
5	Wire ropes: construction, classification, application, inspection, maintenance and calculations; capping and splicing of ropes.	4	
6	Winding: drum winding and Koepe winding; Braking systems: mechanical and electrical.	8	
7	Rope haulages: types, principle of operation, suitability, safety appliances, calculations.	8	Deshmukh, D. J., Elements of Mining Technology, Vol. III, 1994
8	Drainage and pumps.	6	
<b>Total</b>		<b>42</b>	

11. **Details on Tutorials** : At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

### 12. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (V SEMESTER)

1. **Course code** : MN301
2. **Course Title** : **Surface Mining**
3. **L-T-P** : 3-1-0
4. **Credits** : 04
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. M. Aruna**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To impart the knowledge to the students
  - method of opening up of deposits
  - various techniques for determining final pit limits
  - drilling and blasting practices in surface mines
  - various excavation, loading and transporting machineries
  - different open pit layouts, including waste dump layouts
  - environmental and reclamation plan with reference to surface mine projects

### 9. Course outcomes:

After the completion of the course student is expected to have skill in –

CO1: various unit operations involved in surface mining activities

CO2: planning of surface mine projects including determination of final pit limits, environment management and reclamation planning, and their techno-economic evaluation.

CO3: constructional and operational features of various Heavy Earth Moving Machineries.

### 10. Course Plan: 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Dimensions of open pits	4	Hartman H. L. Introductory Mining Engineering, John Wiley & Sons.
2	Techniques for determining final pit limits	3	
3	Production drilling and drill machines	4	
4	Surface blast design and recent trends in blasting	4	
5	Constructional and operational features of excavation and loading equipments	4	G. B. Misra, Surface Mining.
6	Constructional and operational details of transporting equipments	4	
7	Layouts in open pit mines	3	Pflieder, Surface Mining.
8	Methods of opencast mining	4	
9	Layout of waste dumps	3	Rzhvesky V. V, Unit operations in opencast mines, Mir Publishers.
10	Conventional and continuous mining systems	3	
11	Environmental management and reclamation planning	4	
12	Techno-economic evaluation of surface mining projects	3	
<b>Total</b>		<b>43</b>	

### 11. Details on Tutorials : One hour per week

### 12. Evaluation Plan:

- a. Continuous evaluation: :25%  
(Slip tests/Quiz + Assignment)
- b. Mid Semester Performance: :25%
- c. End Semester Performance: :50%

## B.TECH. (V SEMESTER)

1. **Course Code** : MI302
2. **Course Title** : **Mine Hazards, Rescue and Recovery**
3. **L – T – P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Harsha Vardhan**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of the different types of hazards in underground mining and techniques to handle.

### 9. Course outcomes:

After the completion of the course, student is expected to have skills in:

- CO1: Details of underground explosions and techniques to deal with different types of explosions
- CO2: Spontaneous combustion and its control
- CO3: Causes of inundation and the safeguards against it
- CO4: Rescue and recovery work following mine disaster

### 10. Course Plan: 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	Mine explosions: Causes of underground explosions. Coal dust explosions: Explosibility of coal dust, factors affecting explosibility, safeguards against coal dust explosions – cleaning, water treatment, wetting, stone dusting and stone dust barriers. Firedamp explosions: Causes and preventive measures, methane layering.	12	Ramlu, M. A., “Mine Fires, Explosions, Rescue, Recovery and Inundations”; Oxford & IBH Publishing Co. Pvt. Ltd.; New Delhi, 1991.
2.	Spontaneous combustion: Causes, detection and stages; Factors influencing self-heating; Precautions against spontaneous heating in underground mines, surface coal stacks and dumps. Mine fires: Causes and classification of mine fires; Surface and underground fires; Prevention and control of underground fires; Firefighting; Fire extinguishers; Isolation stoppings; Interpretation and analysis of mine atmosphere; Re-opening of sealed-off areas.	12	Vutukuri, V. S. & Lama, R. D. “Environmental Engineering in Mines”; Cambridge University Press; Cambridge, 1986.
3.	Inundation: Causes, precautionary and preventive measures; Approaching water logged areas and old workings. Water dams: Construction and design.	08	Hartman, H. L.; “Mine Ventilation & Air Conditioning”; John Wiley & Sons; New York, 1982.
4.	Rescue equipment and operations: Classification of rescue equipment; First-aid equipment; Short distance breathing apparatus; Self-contained oxygen breathing apparatus; Reviving apparatus. Resuscitation; Rescue stations; Rescue organization.	08	
<b>Total</b>		<b>40</b>	

11. **Details on tutorials:** At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems if any along with experimental demonstration in the lab.

### 12. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Examination : 25 %
- c. End Semester Examination : 50 %

**B.TECH. (VIII SEMESTER)**  
**COURSE OUTCOME AND EVALUATION PLAN (2019 – 2020)**

1. **Course Code** : MN303
2. **Course Title** : Underground Coal Mining
3. **L-T-P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructors** : **Prof. Ch. S. N. Murthy**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make aware of the student:
  - a. Status and scope underground coal mining in India.
  - b. Reserve estimation, commercial reserves, procedure to determine the life and annual output of an underground coal mine. Various methods of Opening up of coal seams by U/g mining.
  - c. Various methods of extraction of coal by underground mining i.e. B&P method (both development and depillaring) by semi mechanization; Long wall mining using DERDs ; Horizon mining.
  - d. Various methods of thick seam mining: slice mining and blasting gallery method; Special methods such as hydraulic mining, underground coal gasification; Working of contiguous seams, seams prone to spontaneous heating

**9. Course outcomes:**

After the completion of the course, student is expected to have skills in:

CO1: Designing the life and annual output of an underground coal mine

CO2: Extraction (both development and depillaring operations) of coal by B&P method with suitable layouts.

CO3: Extraction of coal by long wall mining (by advancing & retreating method) and horizon mining with suitable layouts.

CO4: Various methods of extraction of thick seam mining including blasting gallery method.

CO5: Extraction of coal by special methods like hydraulic mining and underground coal gasification.

**10. Course coverage (40-hours lecture schedule)**

Module	Contents	Approximate no. of lectures	Reference Books
1.	Status and scope of underground coal mining in the country; classification of coal reserves-proved , indicated and inferred	2	R.D.Singh, Principles and Practices of Modern Coal Mining  T.N.Singh, Underground Mining of Coal  D.J.Deshmukh, Elements of Mining Technology, vol-I
2.	Calculation of commercial reserves; Annual output. Opening of coal deposit- by inclines, vertical shafts and Adits; Merits and Demerits of opening up by different modes	4	
3.	Horizon mining- Definition of cross cuts, lateral and haulage level; applicability, layout, advantages and disadvantages	2	
4.	Basic coal mining methods- classification, factors influencing the choice of method. Advantages and disadvantages	2	
5.	Board and pillar mining:- Division of the mine into blocks/panel; sizes of a panel, pillars and headings; opening of a panel/district from main dip, shaft level; development of panel by chain conveyor, SDL(side discharge loader), LHD (load haul dumper), GAL (gathering arm loader) and shuttle car, continuous miner; room & pillar mining	10	
6.	Depillaring: various methods of extraction of pillars by caving and stowing techniques.	4	
7.	Long wall mining: - Basic elements of a long wall mine, advancing and retreating methods: shape, size and method of drivage of roadways: face organizations- cyclic and non-cyclic operations, machinery required- winning, transport and support: sequence of cutting operations and method of mining in long wall mining by by advancing & retreating method. Manpower requirement and output from a long wall face.	6	
8.	Thick seam extraction- scope , problems and classifications of thick seam mining:- choice of method of mining thick coal seams-ascending and descending, and mixed order: slice mining, sub-level caving; blasting gallery method	6	

9.	Special methods : Hydraulic mining; Underground gasification of coal; Working of continuous seams	4	
<b>Total</b>		<b>40</b>	

**11. Evaluation Plan:**

- a. Continuous Evaluation (Slip tests/Quiz +Assignment) : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (V SEMESTER)

1. **Course Code** : MI310
2. **Course Title** : **Noise Pollution and Control Engineering**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. Harsha Vardhan**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : This course provides knowledge on principles of noise control for underground and opencast machinery working in mines.

9. **Course outcomes:**

After the completion of the course, student is expected to have skills in:

CO1: Ill effects of noise and engineering control of noise for machinery working in mines.

CO2: Prevailing noise standards in India and abroad.

CO3: Knowledge on various mathematical models for noise prediction in mines and noise mapping of a mining complex.

CO4: Ill effects of machine induced vibration and its control measures.

10. **Course Plan:** 30 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Noise standards and impact of noise on miners	03	Harris CM: <b>Hand book of noise control</b> ; McGraw-Hill Book Company, 1979.  Albert Thumann & Richard K Miller: <b>Secrets of noise control</b> , The Fairmont Press, Georgia, 1976.  Pal A.K & Saxena N.C: <b>Noise pollution in coal mining complexes</b> ; A monograph by ENVIS Center of Mining Environment; ISM; 1999.  <b>Noise at work</b> : European agency for Safety and Health
2	Basic principles of noise control, Instrument used for noise measurement and analysis.	04	
3	Noise measurement practice for individual noise source, Noise measurement in community and industry.	02	
4	Noise control of mining equipments.	03	
5	Hearing protective devices: Types, Noise reduction capabilities, Principle of operation and use.	02	
6	Noise Impact prediction and assessment by mathematical modeling.	03	
7	Noise pollution and management other industries.	04	
8	Noise abatement measures: Sound absorption, Acoustic barrier. Vibration isolation, vibration damping, muffing and green belt-principles and design considerations.	05	
9	Human vibration: Health effects and Control Measures.	04	
<b>Total</b>		<b>30</b>	

11. **Details on Tutorials:** At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

12. **Evaluation Plan:**

- a. Continuous Evaluation : 25%  
(Class tests +Assignment)
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%



## B.TECH. (VIII SEMESTER)

1. **Course Code** : MN 311
2. **Course Title** : **Mine Mechanization**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Anup K. Tripathi**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of different types of mining equipment used in underground and surface mines

### 9. Course outcomes:

After the completion of the course, student is expected to have skills in:

- CO1. Understanding different types of equipment used underground like locomotive haulage, belt conveyor and other face machinery.
- CO2. Calculations of production and productivity.
- CO3. Understanding in detail the constructional features of aerial ropeways with the calculation.
- CO4. Power distribution systems used in underground and surface mines.

### 10. Course Plan: 33 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Locomotive haulage; Rolling Stocks	4	Ramlu, M. A., Mine Hoisting, Oxford and IBH, New Delhi, 1996  Walker, S. C., Mine Winding and Transport, Elsevier, Amsterdam, 1988  Deshmukh, D. J., Elements of Mining Technology, Vol. III, 1994
2	Conveyor types; Safety devices; Belt conveyor calculations	5	
3	Face machinery; Calculations of productivity of loading machines	2	
4	Aerial ropeways; Aerial ropeway calculations	6	
5	Equipment for pneumatic and hydraulic stowing; Roof bolting machines	4	
6	Concept of intrinsically safe and flame-proof equipment	4	
7	Mine Cables; Power distribution in underground and surface mines	4	
8	Concept of variable and thyristor drives; Remote control; Monitoring and automation of mining processes	4	
<b>Total</b>		<b>33</b>	

### 11. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VII SEMESTER)

1. **Course Code** :MN 312
2. **Course Title** :**Rock Reinforcement Engineering**
3. **L-T-P** :3-0-0
4. **Credits** :3
5. **Prerequisite** :Nil
6. **Course Instructor** :**Dr. K. Ram Chandar**
7. **Teaching Department** :Mining Engineering
8. **Objectives of the Course** : To make aware of the student
  - Types of roof bolts and cable bolts, their design and installation aspects
  - Design and application of shotcreting
  - Cavability of rocks
  - Longwall supports, lining of tunnels and shafts
  - Different supports like yieldable arches and ring sets. Mechanical behaviours and monitoring of various supports
  - Reinforcement of pillars and slopes
  - Concepts of roof convergence, stope closure, back filling.
  - Capital investment of supports, cost control process

### 9. Course outcomes:

At the end of the course, the student is expected to have skills in

CO1:Understanding different types of roof bolts and cable bolts, their design and installation aspects

CO2:Design and application of shotcreting

CO3:Assessing the cavability of rocks

CO4:Understand the different Longwall supports, lining of tunnels and shafts

CO5:Different supports like yieldable arches and ring sets. Mechanical behaviours and monitoring of various supports

CO6:Different method of reinforcement of pillars and slopes

CO7:Concepts of roof convergence, stope closure, back filling.

CO8:Concepts of capital investment of supports, cost control process

### 10. Course Plan: 33 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Roof bolting, cable bolting and shotcreting	8	Biron, C and Ariglu, E., Design of supports in mines  Britton, S.G., Construction engineering in underground coal mines.
2	Cavability of rocks- effect on support design	4	
3	Longwall supports, lining of tunnels and shafts. Yieldable arches and ring sets. Mechanical behaviour and monitoring of supports.	10	
4	Reinforcement of pillar. Stabilization of slopes	5	
5	Stope closure. Back filling	3	
6	Capital investment for supports. Cost control process	3	
	<b>Total</b>	<b>33</b>	

### 11. Evaluation Plan

- a. Continuous evaluation :25%  
(slip test, quiz, assignments etc.)
- b. Mid semester performance :25%
- c. End semester performance :50%

## B.TECH. (V SEMESTER)

1. **Course Code** : MN313
2. **Course Title** : **Mine Power Systems**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Anup Kumar Tripathi**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of various components of a mine power system and methods used for analysis of mine power systems operation under normal and faulted conditions.

**9. Course outcomes:**

After the completion of the course, student is expected to have skills in:

- CO1. Understanding of three-phase circuit analysis and main components of mine power systems
- CO2. Understanding of grounding systems and ground bed construction
- CO3. Understanding of power flow calculations
- CO4. Understanding of methods used for symmetrical and unsymmetrical fault analysis
- CO5. Understanding of protective equipment and relaying techniques

**10. Course Plan:** 32 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Electric power in mining.	04	Morley, L. A., Mine Power Systems, US Bureau of Mines Information Circular 9258, 1990.  Stevenson, W. D. and Grainger, J. J., Power Systems Analysis, 1 <sup>st</sup> Edition, McGraw Hill, 1994.  Nasar, S. A. and Trutt, F. C., Electric Power Systems, 1 <sup>st</sup> Edition, CRC Press, 1998.
2	Three-phase circuit analysis; Components of mine power systems.	05	
3	Grounding systems; Ground bed construction.	06	
4	Power flow calculations; Reactive power control.	05	
5	Per unit representation; Symmetrical components; Analysis of symmetrical and unsymmetrical faults on mine power systems	06	
6	Transients and overvoltages; Protective equipment and relaying.	06	
<b>Total</b>		<b>32</b>	

- 11. Details on Tutorials** : At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

**12. Evaluation Plan:**

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VI SEMESTER)

1. **Course Code** : MN351
2. **Course Title** : **Underground Metal Mining**
3. **L-T-P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructor** : **Prof. M. Govinda Raj and Prof. K.U.M. Rao**
7. **Teaching Department** : Mining Engineering
8. **Course outcomes:**

After the completion of the course, student is expected to have skills in:

CO1: Comparative assessment of Coal and Metal mines; Basics of Ore Body Modeling (OBM).

CO2: Develop clarity on various underground metal mining methods, such as supported, unsupported and caving methods

CO3: Challenges faced in Deep mining and Solution mining

CO4: Gain knowledge of Specific Indian / International case studies.

CO5: Understand the operation of International metals / ore markets (LME, NYMEX etc.)

### 9. Course Plan: 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	Comparative assessment of Coal Vs Metal Mining	3	Hartman H. L. Introductory Mining Engineering, John Wiley & Sons.
2.	Ore body modelling- Basics of Geostatistics ; Planning Main Mine entries.	4	
3.	Draw points and ore passes and other mine Developmental excavations	4	Hustrulid W. A. SME Handbook on Metalliferous mining.
4.	Methods of stoping: Supported methods	4	
5.	Methods of stoping: Unsupported methods	5	Tarasov, 1983, Mining practice, Mir Publishers.
6.	Methods of stoping: Caving methods	5	
7.	Problems in deep mining	3	Deshmukh D. J., 1998, Elements of Mining Technology, Vol. II, Central Techno Publications, Nagpur.
8.	Solution mining and in-situ leaching	4	
9.	Case studies from Indian mines	4	
10.	Techno-Economics, London Metal Exchange ( L.M.E.) Etc.	4	
<b>Total</b>		<b>40</b>	

### 10. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VI SEMESTER)

1. **Course Code** : MN352
2. **Course Title** : **Rock Mechanics**
3. **L-T-P** : 3-1-0
4. **Credits** :4
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. K. Ram Chandar**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the course** : To make aware of the student in the following topics
  - Stresses and strains and their inter relationship
  - Physical, physico mechanical and insitu properties of rocks
  - Elastic constants
  - Rheological models
  - Rock mass classification
  - Rock fracture mechanics

### 9. Course outcomes:

At the end of the course, Student expected to

- CO1: Have knowledge of stress, strain and their relationship
- CO2: Know the various properties of rocks, their determination and application
- CO3: Know the applications of Rheological models
- CO4: Know the different rock mass classifications, applications and limitations
- CO5: Knowledge of rock fracture mechanics

### 10. Course Plan: 44 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	Definition, Classification and the applications of Rock Mechanics, Analysis of stresses and strains. Differential equations in elastic theory, Mohr's representation of stress and strain relationships.	13	Rock mechanics and design of structures in Rock by Obert and Duvall  Introduction to Rock Mechanics by Goodman  Rock Mechanics by W. Wittke
2.	Behavior of rock under stress, physical properties, Physio mechanical properties of rocks, elastic constants under static and dynamic loading	11	
3.	Determination of insitu strength properties	4	
4.	Rheological models	3	
5.	Engineering Rock mass classifications	9	
6.	Rock Fracture Mechanics.	4	
<b>Total</b>		44	

11. **Details on Tutorials** : At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

### 12. Evaluation Plan:

- a. Continuous evaluation (Slip tests/ quiz + assignment) : 25%
- b. Mid sem Performance : 25%
- c. End Sem Performance : 50%

## B.TECH. (VI SEMESTER)

1. **Course Code** : MI353
2. **Course Title** : **Rock Mechanics Lab**
3. **L-T-P** : 0-0-3
4. **Credits** : 2
5. **Prerequisites** : Nil
6. **Course Instructors** : **Dr Karra Ram Chandar & Dr Sandi Kumar Reddy**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To impart the knowledge to the students about the determination of various rock properties in the laboratory.

### 9. Course outcome:

After the completion of the course, student is expected to have skills in:

CO1: Understanding the concept of rock mechanics laboratory testing of rocks.

CO2: Knowledge of rock mechanics testing apparatus/equipment used.

CO3: Practical usage of rock mechanics testing apparatus/equipment.

CO4: Practical experience on Sample preparation for different tests in laboratory.

CO5: Practical experience on different tests (Uniaxial compressive strength, Tensile strength, Shear strength, Protodyakonov's strength index, Impact strength index, Point load strength, Longitudinal wave velocity, Slake durability index, resistance to abrasion, Modulus of Elasticity and rock burst liability index) of given rock sample.

### 10. Course plan: 13 hours

Sl. No.	Title of Experiment	No. of Lab Classes
1	Concept of rock mechanics laboratory testing of rocks with different equipments	01
2	Determination of Uniaxial compressive strength of a given rock sample	01
3	Determination of Tensile strength of a given rock sample	01
4	Determination of Shear strength (single and double) of a given rock sample	01
5	Determination of Protodyakonov's strength index of a given rock sample	01
6	Determination of Impact strength index of a given rock sample	01
7	Determination of Point load strength index of a given rock sample	01
8	Determination of Longitudinal wave velocity of a given rock sample	01
9	Determination of Slake durability index of a given rock sample	01
10	Determination of resistance to abrasion of aggregate using Los Angles machine	01
11	Determination of Modulus of Elasticity of a given rock sample	01
12	Determination of Cohesive strength and angle of internal friction using oblique shear test	01
13	Determination of rock burst liability index of a given rock sample	01
<b>Total</b>		<b>13</b>

### 11. Evaluation Plan:

- a. Continuous evaluation : 60%
- b. End semester performance : 40%

## B.TECH. (VI SEMESTER)

1. **Course Code** : MN354
2. **Course Title** : **Mine Systems Engineering**
3. **L-T-P** : 3-1-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Anup K. Tripathi**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To make the students aware of various systems engineering techniques applied to mining industry

### 9. Skill development of the student expected from the course:

After the completion of the course, student is expected to have skills in:

- CO1. Understanding of linear programming and simplex methods
- CO2. Understanding of CPM and PERT techniques, dynamic programming, integer programming and inventory control
- CO3. Understanding of transportation models and assignment models
- CO4. Understanding of simulation techniques and queuing theory
- CO5. Understanding of management information systems

### 10. Course Plan: 44 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	System concept and analysis; Concepts of statistical decision theory	04	Sharma J. K., 1989, "Mathematical Models in Operations Research", Tata McGraw-Hill, New Delhi  Cummins, A. B., 1973, "Mining Engineering Handbook", Vol. II, SME, AMIE, New York
2	Network techniques for mining projects; CPM and PERT techniques	06	
3	Linear programming	08	
4	Transportation models; Assignment models	04	
5	Integer programming; Dynamic programming	06	
6	Inventory control	04	
7	Simulation techniques for equipment selection and production scheduling; Queuing theory	08	
8	Significance of management information systems in controlling and managing the mining activities	04	
<b>Total</b>		<b>44</b>	

11. **Details on Tutorials** : At each stage mentioned above, the theoretical aspects will be dealt in detail by solving numerical problems.

### 12. Evaluation Plan:

- a. Internal Assessment : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VI SEMESTER)

1. **Course Code** : MN360
2. **Course Title** : **Advanced Underground Coal Mining**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisites** : Underground Coal Mining
6. **Course Instructors** : **Dr Bijay Mihir Kunar & Dr Sandi Kumar Reddy**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : This course provides knowledge on planning and design considerations for various underground methods of working in coal mines.

### 9. Course outcomes:

After the completion of the course, student is expected to have skills in:

CO1: Understanding the concept of choose a method of working in underground coal mines.

CO2: Sound Knowledge on Bord & Pillar method of working, and Longwall method of working, problems and control in underground coal mines.

CO3: Knowledge on thick seam mining method of working, problems and control in underground coal mines.

CO4: Knowledge on highwall method of working in coal mines.

CO5: Knowledge on punch entry method of working in coal mines.

### 10. Course plan: 33 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Various criteria for selection of underground methods: B&P and L/W method in India	03	Singh, T.N., Thick seam Mining, Oxford & IBH, 1992.  Vorbjev & Deshmukh, Advanced Coal Mining, Tata McGill, 1988.  Mathur, S.P., Advanced Coal Mining, M.S. Enterprises Bilaspur, 1999.
	B&P Method: Pillar construction, Panel size, etc., Continuous Miner workings	05	
	Caving characteristics of roof rocks	03	
2	L/W Method: Advancing, Retreating, Long wall face machinery: Coal Plough, Shearer, AFC.	07	
	Power Support: Two leg and four leg chock support and hydraulic chock shield support	04	
3	Thick Seam working: Problems associated with Thick Seam Working, Methods of working of thick coal seam, Komaro method, Soutirage method and shield mining method.	06	
4	Subsidence: Factors affecting subsidence, Measurement and Control	03	
5	Highwall Mining, Punch Entries	02	
<b>Total</b>		<b>33</b>	

### 11. Evaluation Plan:

- a. Continuous Evaluation (Class tests +Assignment) : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%



## B.TECH. (VI SEMESTER)

1. **Course Code** : MN361
2. **Course Title** : **Advanced Surface Mining Technology**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisites** : Surface Mining
6. **Course Instructors** : **Dr M. Aruna**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To impart knowledge about:
  - a. Selection and application of equipments in surface mine projects
  - b. Basic unit operations vis-à-vis machine selection considerations
  - c. Equipment planning for entire project vis-à-vis mine production.

### 9. Course outcomes:

After the completion of the course student is expected to have skills in –

CO1: Selection of equipments for various mining operations

CO2: Basic operations of HEMM and their maintenance

CO3: Applicability of different mining machinery

CO4: Computations for the capacity and number of machines

### 10. Course plan: 35 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Classification of surface mining equipments, constructional and operational features	6	Hartman H. L. Introductory Mining Engineering, John Wiley & Sons.
2	Unit operations in surface mine projects.	5	Martin & Martin, 1982, Surface Mining Equipment, Martin Consultants, U.S.A.  Amithosh Dey, 1995, Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad.
3	Loading equipments/systems	5	
4	Transporting equipments/systems	5	
5	Equipment selection criteria and inputs.	5	
6	Applicability and selection considerations	4	
7	Computations for the capacity and number of machines vis-à-vis mine production	5	
<b>Total</b>		<b>35</b>	

### 11. Evaluation Plan:

- a. Continuous Evaluation : 25%  
(slip tests/quiz + assignment + seminar)
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VII SEMESTER)

1. **Course Code** : MN401
2. **Course Title** : **Mineral Processing**
3. **L-T-P** : 4-0-0
4. **Credits** : 4
5. **Prerequisites** : Nil
6. **Course Instructors** : **Prof. M. Govinda Raj**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : The course intends to provide knowledge regarding the Processing Technologies of various metallic and Non-metallic ores / minerals / coal etc.

**9. Course outcomes:**

After the completion of the course student is expected to have skills in –

- CO1: Understanding the concept of Ore sampling, ore sorting machines.
- CO2: Sound knowledge of the basic Unit operations of Processing viz: Liberation and comminution; Sizing/sieve analysis; Concentration Operations and Miscellaneous operations.
- CO3: Thorough knowledge of Gravity separation, High density separation Magnetic and high tension separation; Forth floatation etc.
- CO4: Knowledge of Coal preparation; Dewatering methods and Tailings disposal.

**10. Course plan:** 40 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Scope of mineral processing, Ore handling and storage, ore sorting and sampling techniques	05	Will.,B.A Mineral Processing Technology: Pergamon Press Truscot, Hand book on Mineral Engineering. Gaudin, A.M., Principles of Mineral Dressing, TMH Edition
2	Concept of liberation & Communication Different crushing and grinding equipment their selection and performance	06	
3	Laboratory and industrial sizing, sieve analysis	04	
4	Principles of classification, classifiers and hydro cyclones	04	
5	Gravity methods of separation, magnetic separation, high tension separation	07	
6	Forth floatation	04	
7	Dense Medium Separation, wash ability curves	05	
8	Dewatering techniques, tailings disposal	05	
<b>Total</b>		<b>40</b>	

**11. Evaluation Plan:**

- a. Continuous Evaluation : 25%  
(slip tests/quiz + assignment + seminar)
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VII SEMESTER)

1. **Course Code** : MN402
2. **Course Title** : **Mineral Processing Laboratory**
3. **L-T-P** : 0-0-3
4. **Credits** : 2
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Anup Kumar Tripathi and Prof. M. Govinda Raj**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To impart the knowledge to the students about the various mineral processing techniques in the laboratory

**9. Course outcomes:**

CO1: At the end of the course, the student is expected to know the application of each experiment and be able to do given processing technique using suitable apparatus/ equipment.

**10. Course Plan:**

**List of Experiments**

Sl. No.	Title of Experiment	No. of Lab Classes
1	Preparation of required sample using coning and quartering	1
2	Preparation of required sample using riffle sampler	1
3	Study of crushing characteristics of jaw crusher using the samples obtained from multi-deck vibrating screen	1
4	Study of crushing characteristics of roller crusher using the samples obtained from multi-deck vibrating screen	1
5	Study of grinding characteristics of ball mill	1
6	Study of grinding characteristics of rod mill	1
7	Separation of given mixture using Wilfley's table and jigging machine	1
8	Concentration of grinded ore using froth flotation cell	1
9	Study of sedimentation characteristics of given sample	1
10	Preparation of washability curves using sink and float test	1
11	Separation of given mixture using spiral classifier and hydro-cyclone	1
12	Enrichment of given ore using magnetic separator and Davi's tube tester	1

**11. Evaluation Plan:**

- a. Continuous evaluation : 60%
- b. End semester performance : 40%

## B.TECH. (VII SEMESTER)

1. **Course Code** : MN410
2. **Course Title** : **Rock Fragmentation Engineering**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Prof. V.R. Sastry**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To make aware of the student
  - Concepts of drillability indices, specific energy and their applications in selection of suitable drills.
  - Bulk explosives systems used in mines and substitutes for explosives.
  - Blast design in mines
  - Concepts and theories of rock fragmentation
  - Fragmentation prediction models and assessment.
  - Theory of shaped charges
  - Latest developments in surface and U/G blasting techniques
  - Under water blasting
  - Environmental effects of blasting
  - Controlled blasting and economic evaluation of blasting.

### 9. Course outcomes:

At the end of the course, the student is expected to have skills in

CO1: Selection of suitable drill machines in different rock formations based on drillability and specific energy

CO2: Design of blasts and selecting suitable explosives

CO3: Understanding the different rock breakage mechanisms.

CO4: Predicting rock fragmentation using different mathematical models and also analysing the fragmentation using different assessing methods.

CO5: Latest developments in UG and surface blasting.

CO6: Concepts of underwater blasting.

CO7: Environmental effects and their control measures.

CO8: Economic evaluation of blasting operations.

### 10. Course Plan: 34 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Drillability indices. Specific energy. Drilling costs. Determination of drill availability and utilization	4	Konya, C.G. Blast design.
2	Bulk explosive systems. Substitute for explosives	5	
3	Blast design. Mechanisms of rock fragmentation due to blasting.	5	
4	Fragmentation prediction and assessment	5	Person, P.A, Holmberg, R and Lee, J. Rock blasting and explosives engineering.
5	Theory of shaped charges. Recent advances in U/G and surface blasting techniques. Special techniques of blasting	5	
6	Underwater blasting	4	
7	Environmental effects of blasting and their control. Controlled blasting techniques.	4	
8	Economic evaluation of blasting operations	2	
<b>Total</b>		<b>34</b>	

### 11. Evaluation Plan:

- a. Continuous evaluation :25%  
(slip test, quiz, assignments etc.)
- b. Mid semester performance :25%
- c. End semester performance :50%

## B.TECH. (VII SEMESTER)

1. **Course Code** :MN411
2. **Course Title** :Strata Mechanics
3. **L-T-P** :3-1-0
4. **Credits** :4
5. **Prerequisite** :Nil
6. **Course Instructor** :Dr. K. Ram Chandar
7. **Teaching Dept** :Mining Engineering
8. **Objectives of the Course:** To make aware of the student
  - Concepts of strata mechanics / ground control
  - State of stress in underground openings, influence of water, temperature and time on stress behaviour
  - Design of pillars
  - Different types of supports
  - Subsidence- prediction, prevention
  - Rock burst and coal bumps

### 9. Course Outcomes:

At the end of the course, the student is expected to

CO1:Know the importance of stress on underground openings both in single and multiple openings and also in different shaped openings

CO2:Design of pillars, open pit slopes, waste dumps

CO3:Know the different types of supports used in mines, different criteria to design and select the suitable supports.

CO4:Know the concept, prediction, prevention and determination of subsidence

CO5:Causes and effects of coal bumps and rock bursts

### 10. Course Plan: 44 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	Concept of ground control in mines, state of stress in underground openings, pre-mining and induced stresses, influence of water, time and temperature on stress behaviour	7	Rock Mechanics and Design of Structures in Rock: Obert and Duvall
2.	Design of pillars	3	
3.	Design of open pit slopes and dumps	7	Coal mine ground control: Peng. S
4.	Conventional and powered supports, rock reinforcement design	10	
5.	Concept, prediction, determination of subsidence, damage due to subsidence and prevention	10	Design of supports in mines: Biron. C
6.	Rock bursts, coal bumps- mechanisms, prediction and estimation of damage	7	
<b>Total</b>		<b>44</b>	

### 11. Details on Tutorials : 1 Hour tutorial per week

### 12. Evaluation Plan:

- a. Continuous evaluation :25%  
(slip test, quiz, assignments etc.)
- b. Mid semester performance :25%
- c. End semester performance :50%

## B.TECH. (VII SEMESTER)

1. **Course Code** : MN412
2. **Course Title** : **Mine Health and Safety Engineering**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. B.M. Kunar**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : To prepare the students to know about different risk analysis procedure for assessment of risk at workplaces due to presence of different type of occupational hazards.

**9. Course outcomes:**

CO1: Understanding various types of occupational hazards occurring in mines.

CO2: Understanding ways to analyze and control the occupational hazards: engineering approach and systems approach.

CO3: Safety planning, analysis and management.

CO4: Analyzing economics of safety measures and their cost effectiveness

**10. Course Plan:** 30 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	<b>Health and Safety Management:</b> Concept of Safety Engineering and its roll on Health and Safety, Elements of Health and Safety Management, System Model of Health and Safety Management, System failure and Injury Dynamics in Mining.	03	L.C. Kaku: <b>A Study of Mine Management, Legislation and General Safety</b> , Lovely Prakashan Dhanbad  Ridley, J & Channing J: <b>Safety at Work</b> ; Oxford  C.P. Singh: <b>Occupational Safety and Health in Industries and Mines</b> . Black Diamond Publishers, Nagpur  Ghatak S: <b>A Study of Mine Management, Legislation and General Safety</b> , Lovely Prakashan Dhanbad  Debi Prasad Tripathy: <b>Mine Safety Science and Engineering</b> , CRC Press, T&F, Boca Rayton, London New York  Class Notes.
2	<b>Measurement Techniques in Safety Management:</b> Measurement of results of accident by accident frequency and severity rates, Combined index, Assessment of severity/risk index by Risk Matrix. Concept of Safety Audit.	03	
3	<b>Accident:</b> Type of Accident, Classification of accident, Major cause of accident, Accident report, Cost of accident. Accident causation Model, Accident Enquiry & Report writing	05	
4	<b>Hazard, Risk &amp; Risk Management plan:</b> Hazard, Risk, Scale for Risk Management plan, Risk identification, Risk assessment and Risk control. <b>Safety Management Plan:</b> Procedure for development of safety management plan.	08	
5	<b>Safety Analysis Methods:</b> Job safety Analysis, Fault tree analysis, Hazop study, Loss Control Technique etc.	05	
6	<b>Occupational Disease:</b> Respiratory system disease, Diseases from metal: Lead, Mercury etc.	02	
7	Problems of safety and health in contractual works, Safety Culture, Concept of Ergonomics Application in Mine Safety	04	
<b>Total</b>		<b>30</b>	

**11. Evaluation Plan:**

- a. Continuous Evaluation (Class tests + Assignment) : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VIII SEMESTER)

1. **Course Code** : MN413
2. **Course Title** : **Rock Slope Engineering**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. S.K. Reddy**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : This course provides knowledge on rock slope engineering related to all opencast mines in India.

9. **Course outcomes:**

After the completion of the course, student is expected to have skills in:

CO1: Understanding rock slope failure in opencast mines.

CO2: Sound Knowledge on types of failures.

CO3: Sound knowledge on various factors affecting slope failure.

CO4: Sound knowledge on Field investigations and data collection related to rock slope engineering.

CO5: Sound knowledge of design of slopes, slope stabilization and slope monitoring.

10. **Course Plan:** 33 hours

Module	Contents	Approximate no. of lectures	Reference Books
1	Mechanism of rock slope failures	03	Hoek, E. and Bray, J.W; Rock Slope Engineering; John Wiley & Sons; New York; 1984 Brawner, C.O;  Stability in surface mining, SME of USA; New York, 1982.  Giani, F; Rock Slope Stability Analysis; Balkema; Rotterdam; 1992.
2	Types of slope failures, Factors affecting slope failure	06	
3	Field investigations and data collection related to rock slope engineering	04	
4	Design of slopes- empirical, probabilistic and analytical methods	04	
5	Design of slopes- Numerical modeling	07	
6	Stabilization and reinforcement of slopes	04	
7	Slope failure monitoring	05	
<b>Total</b>		<b>33</b>	

11. **Evaluation Plan:**

- a. Continuous Evaluation : 25%  
(Class tests +Assignment)
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VIII SEMESTER)

1. **Course Code** : MN451
2. **Course Title** : **Mine Legislation**
3. **L-T-P** : 4-0-0
4. **Credits** : 4
5. **Prerequisite** : Nil
6. **Course Instructors** : **Prof. Ch. S. N. Murthy**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** :
  - a. About Mining legislation in India – History and Development (in brief)
  - b. About important provisions of The Mines Act, 1952; The Mines Rules, 1955; The Coal Mines Regulation, 1957; The Metalliferous Mines regulation, 1961; The Mines Rescue Rule, 1985 etc.
  - c. About important provisions of Payment Wages Act, Provident fund Act, NCWB, Creche rules
  - d. About important provisions of the Mines and Minerals (Regulation and Development) Act, 1957; The Mineral Conservation Rules (MCR), 1960.

### 9. Course outcomes:

After the completion of the course, student is expected to have skills in:

CO1: Learn/improve knowledge regarding various statutory laws in mining areas.

CO2: Knowledge about statutory duties of various officers/ Supervisors in mining.

CO3: Take right decision to improve safety in mines

CO4: Enhance capability to improve the health of workers.

### 10. Course Plan: 56 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	History & Development of mining legislation in India; various Acts, Rules and Regulations pertaining to mining industry	3	The Mines Act, 1952
2.	The Mines Act, 1952	5	
3.	The Mines Rules, 1955	5	The Mines Rules, 1955
4.	The Mines Rescue Rules, 1985	3	The Mines Rescue Rules, 1985
5.	Important provision of Payment of wages Act and NCWB	2	a) Legislation in Indian Mines – A critical appraisal. Vol. I & II b) The Payment wages Act, 1936
6.	Important provision of Coal Mines Provident Fund Act & Rules, Creche rules	3	a) Coal Mines Provident Fund Act & Rules, 1984 b) Mine Creche rules, 1966
7.	The Indian Electricity Rules, 1956	3	The Indian Electricity Rules, 1956
8.	The Coal Mines Regulation, 2017 and the Metalliferous Mines Regulation, 1961	10	a) Coal Mines Regulation, 2017 b) Mines Regulation, 1961
9.	The Mines & Minerals (Regulation & Development) Act, 1957	4	The Mines & Minerals (Regulation & Development) Act, 1957
10.	Mineral Conservation Rules, 1960	2	Mineral Conservation Rules, 1960
<b>Total</b>		<b>45</b>	

### 11. Evaluation Plan:

- a. Continuous Evaluation : 25%  
(Class tests + Assignments)
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%



**B.TECH. (VIII SEMESTER)**

1. **Course Code** : MN464
2. **Course Title** : **Computer Applications in Mining**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructors** : **Dr. B.M. Kunar**
7. **Teaching Department** : Mining Engineering
8. **Objective of the Course** : This course provides knowledge on development of algorithm and various IT tools applications in mining Industry.

**9. Course outcomes:**

After the completion of the course, student is expected to have skills in:

CO1: Understanding the concept of algorithm development.

CO2: Computer applications in ore reserve estimation

CO3: Optimization of pit, blast design and ventilation using computer application.

CO4: Knowledge of Auto CAD in planning

CO5: Knowledge of SURPAC, MATLAB and SPSS software and practical use in mining Industry.

**10. Course Plan: 31 hours**

Module	Contents	Approximate no. of lectures	Reference Books
1.	Development of algorithms and flow chart for mining operations:		Ram, R. V. et. al. Computers in mineral Industry.  Open pit mine planning and design, Bulkema, 1995.  SURPAC Software manual.  GIAN Course on Computer Application and Data analysis in Mining  Theory and practice on Terrestrial Laser Scanning Training material based
	a)Drilling and Blasting	03	
	b)Transportation	03	
	c)Safety	04	
2.	Computer applications in		
	a)Ore reserve estimation	02	
	b)Pit limit determinations	02	
	c)Production Planning	02	
3.	Optimization. Computational optimization techniques. Problem solving session with examples related to Optimization algorithms	03	
4.	Modeling and simulation (MATLAB), Project planning., Modeling and simulation and planning, Digitization and Mapping of Earthworks, Problem solving session with examples:	06	
5.	Statistical Package for the Social Sciences (SPSS). Problem solving session with examples: SPSS software package, Safety data base management system.	06	
<b>Total</b>		<b>31</b>	

**11. Evaluation Plan:**

- a. Continuous Evaluation (Class tests +Assignment) : 25%
- b. Mid Semester Exam : 25%
- c. End Semester Exam : 50%

## B.TECH. (VIII SEMESTER)

1. **Course Code** : MN465
2. **Course Title** : **Environmental Management and Sustainable Development**
3. **L-T-P** : 3-0-0
4. **Credits** : 3
5. **Prerequisite** : Nil
6. **Course Instructor** : **Dr. Charan Kumar Ala**
7. **Teaching Department** : Mining Engineering
8. **Objectives of the Course** : To impart knowledge on environmental problems with respect to different types of mines, Environmental Management System, Environmental Impact Assessment, Environmental Management Plan, Environmental Audit, Environmental Risk Assessment & Management, Environmental Legislation.

### 9. Course Outcomes:

After the completion of the course, the student is expected to have skills in

CO1: Various environmental issues in the mining projects

CO2: Environmental Impact Assessment & Management

CO3: Environmental Legislation

CO4: Corporate Social Responsibility

CO5: Sustainable development practices in mining industry

### 10. Course plan: 33 hours

Module	Contents	Approximate no. of lectures	Reference Books
1.	Environmental issues in different types of mines – Coal, Iron Ore, Limestone, and Stone	04	Dhar, B. B. (Ed.). (1990). <i>Environmental management of mining operations</i> . Ashish Publishing House.  Chadwick, M. J., Highton, N. H., & Lindman, N. (Eds.). (2013). <i>Environmental impacts of coal mining &amp; utilization: A complete revision of environmental implications of expanded coal utilization</i> . Elsevier.  Lodhia, S. K. (2018). <i>Mining and Sustainable Development: Current Issues</i> . Routledge.
2.	Environmental Management System	02	
3.	Environmental Impact Assessment	03	
4.	Environmental Management Plan	02	
5.	Pollution Standards	03	
6.	Pollution Monitoring & Instrumentation	04	
7.	Water Pollution & Control	03	
8.	Environmental Audit	03	
9.	Corporate Social Responsibility, DPE Guidelines	03	
10.	Sustainable Development, New initiatives by Govt. of India	03	
11.	Case Studies	03	
<b>Total</b>		<b>33</b>	

### 11. Evaluation Plan

- a. Continuous Evaluation :25%  
(Class tests +Assignment + Seminar)
- b. Mid Semester Exam :25%
- c. End Semester Exam :50%