BHAGWANT UNIVERSITY AJMER
B.TECH (MINING ENGINEERING)

Semester III

Subject Code	Name of Subject	Teaching Period			Credit Points
		L	T	P	
03BMI101	Mine Development	3	1	0	4
03BMI102	NUMERICAL AND STATISTICAL METHODS	3	1	0	4
03BMI103	Mechanics of Solids	3	1	0	4
03BMI104	Mining Geology	3	1	0	4
03BMI105	Basic Surveying	3	1	0	4
03BMI106	Mineral Exploration	3	1	0	4
03BMI201	Numerical Methods Laboratory	0	0	2	1
03BMI202	Electrical Engineering Laboratory	0	0	2	1
03BMI203	Mining Geology & Exploration Laboratory	0	0	3	2
03BMI204	Mechanics of Solids Laboratory	0	0	2	1
03BMI301	Discipline & Co-Curricular Activities	0	0	3	1
Total		18	6	12	30

Semester IV

Subject Code	Name of Subject	Teaching Period			Credit Points
		L	T	P	
04BMI101	Mine Surveying	4	0	0	4
04BMI102	Mathematics IV	4	0	0	4
04BMI103	Rock Mechanics	4	0	0	4
04BMI104	Mining Machinery	3	1	0	4
04BMI105	Introductory Mining Technology	4	0	0	4
04BMI106	Material Handling Systems	4	0	0	4
04BMI201	Mining Machinery Laboratory	0	0	2	1
04BMI202	Electronics Engineering Laboratory	0	0	2	1
04BMI203	Rock Mechanics Laboratory	0	0	2	1
04BMI204	Mine Surveying Laboratory	0	0	2	1
04BMI301	Discipline & Co-Curricular Activities	0	0	4	1
Total		23	1	12	29

Semester V

Subject Code	Name of Subject	Teaching Period			Credit Points
		L	T	P	
05BMI101	Mine Ventilation	4	0	0	4
05BMI102	System Engineering	4	0	0	4
05BMI103	Computer Application in Mining	4	0	0	4
05BMI104	Surface Mining Technology	3	1	0	4
05BMI105	Mineral Processing Technology	3	1	0	4
05BMI106	Solid Waste Management	3	1	0	4
05BMI201	Mine Ventilation Laboratory	0	0	2	1
05BMI202	Mineral Processing Technology Laboratory	0	0	2	1
05BMI203	Material Handling Systems Laboratory	0	0	2	1
05BMI204	Computer Application in Mining Laboratory	0	0	2	1
05BMI301	Discipline & Co- Curricular Activities	0	0	4	1
	Total	21	3	12	29

Semester VI

Subject Code	Name of Subject	Teaching Period			Credit points
		L	T	P	
06BMI101	Mine Environmental Engineering	3	1	0	4
06BMI102	Underground Mining Technology	3	1	0	4
06BMI103	Geomechanics	3	1	0	4
06BMI104	Ground Control Instrumentation	3	1	0	4
06BMI105	Remote Sensing and Its Application	3	1	0	4
06BMI106	Mine Economics	3	1	0	4
06BMI201	Mine Environmental Engineering Laboratory	0	0	2	1
06BMI202	Geomechanics Laboratory	0	0	2	1
06BMI203	Model preparation laboratory	0	0	2	1
06BMI204	Simulation and Modeling of Mining systems Laboratory	0	0	3	2
06BMI301	Discipline & Co- Curricular Activities	0	0	3	1
	Total	18	6	12	30

Semester VII

Subject code	Name of subject	Teaching Periods			Credit Points
		L	T	P	
07BMI101	Advanced Surface Mining	3	1	0	4
07BMI102	Mine Legislation and Safety Engineering	3	1	0	4
07BMI103	Industrial Management	3	1	0	4
07BMI104	Tunneling	3	1	0	4
07BMI105	Advanced Coal Mining	3	1	0	4
07BMI106	Mine Planning-I	3	1	0	4
07BMI201	Minor Project	0	0	4	2
07BMI202	PRACTICAL TRAINING & INDUSTRIAL VISIT	0	0	2	1
07BMI203	Mine Planning and Design Laboratory	0	0	3	2
07BMI301	Discipline & Co- Curricular Activities	0	0	2	1
	Total	18	6	12	30

Semester VIII

Subject Code	Name of Subject	Teaching Period			Credit Points
		L	T	P	
08BMI101	Mine Planning-II	3	1	0	4
08BMI102	Advanced Metaliferrous Mining	3	1	0	4
08BMI103	Environmental Pollution and Control in Mines	3	1	0	4
08BMI104	Safety engineering	3	1	0	4
08BMI105	Eco-friendly Mining	3	1	0	4
08BMI201	Mine Planning and Design Laboratory	0	1	5	3
08BMI202	Major Project	0	0	5	3
08BMI203	Seminar	0	0	2	1
08BMI301	Discipline & Co- Curricular Activities	0	0	4	1
	Total	15	5	16	28

Semester III

MINE DEVELOPMENT

Course/Paper: 03 BMI -101
BMI Semester-III

03BMI-101

Introduction: Distributions of mineral deposits in India and other countries, mining contributions to civilization, mining terminology, stages in the life of the mine - prospecting, exploration, development, exploitation and reclamation, access to mineral deposit- selection, location, size and shape (incline, shaft and adit),brief overview of underground and surface mining methods. ; Drilling: Types of drills, drilling methods, electric, pneumatic and hydraulic drills, drill steels and bits, drilling rigs, and jumbos. ; Explosives: Classification, composition, properties and tests, fuses, detonators, blasting devices and accessories, substitutes for explosives, handling and storage, transportation of explosives. ; Rock blasting: Mechanism of rock blasting, blasting procedure, and pattern of shot holes. ; Shaft sinking: Ordinary and special methods, problems, and precautions, shaft supports and lining.

Essential Reading:

1. R. P. Pal, *Rock blasting effect and operation,* A. A. Balkema 1st Ed, 2005.
2. D. J. Deshmukh, *Elements of mining technology,* Vol. 1, Central Techno Publications, Nagpur, 7th Ed, 2001

Supplementary Reading:

1. B. H. Gary, *Blasting operations,* Mc-graw Hill,1st ed,1981.
2. R. P. Pal, *Blasting in ground excavations and mines,* Oxford and IBH, 1st Ed, 1993.
3. C. P. Chugh, *Drilling technology handbook,* Oxford and IBH, 1st Ed, 1977.
4. R. D. Singh, *Principles and practices of modern coal mining, New age international,* 1st Ed, 1997.
5. S. K. Das, *Explosive and blasting practices in mines,* Lovely prakashan, 1st Ed, 1993.
6. P. K. Rajameny, A Joshi, and S. Bhandari, *Blast design and Practice,* Himanshu Publications, Udaypur, 2006.

NUMERICAL AND STATISTICAL METHODS

Course/Paper: 03 BMI -102
BMI Semester-III

Unit 1 Forward, backward , central and Divided differences,
Newton's formula of interpolation for equal and unequal intervals. Lagrange's interpolation formula, Stirling's and Bessell's formula,

Unit 2

Solutions of systems of equations (Gauss elimination, Gauss Jordan, and Partition method for linear system of equations, power method for partition, method for linear system of equations, power method for finding eigen values),

Unit 3

Numerical differentiation, Numerical Integration:- Trapezoidal, Simpson's rule and Gaussian integration (only formula applications) Differential equations and their solutions. Numerical methods for ordinary differential equations (Picard method, Taylor series method, Euler's method, Ranga Kutta Method, Predictor- corrector method, Adams- Bashforth method).

Unit 4

Sampling theory: Introduction: Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression, Normal sampling distributions; Binomial distribution, Poisson distribution, Normal distribution; Sampling distribution of the means; sampling distribution of the differences of the means; sampling distributions of proportions.

Unit 5

Tests of Significance; t-distributions, chi square distributions, F-distributions.
Regression And Correlation; Linear regression; correlation, multiple correlation & partial correlation Confidence Limits; Large samples, small samples, error bands in regression

Reference

a. Numerical Methods and Applied Statistics : Nupur Srivastva,Dr Anita Bhagora Dr Vivek Kumar Sharma—Geneous Publication Jaipur
b. Numerical Methods and Applied Statistics: Gokharoo, Jain ,Pareekh –Unique Publication Ajmer
Computer Based Numerical & Statistical Techniques: Udit Aggarwal- Dhanpat Rai Publication Delhi

MECHANIC OFSOLIDS

Course/Paper: 03 BMI -103
BMI Semester-III

Unit – 1

Stress & strain: Tension, compression, shearing stress & strain; Poisson's ratio: Stress-strain relationship, Hooke's law; equations of static = w for 2D & 3D cars Elastic constants and their relations for a isotropic hookean material, anisotropy & orthotropy, thermal stresses, composite bars; simple elastic, plastic & visco-elastic behavior of common materials in tension and compression test, stress- strain curves. Concept of factor of safety & permissible stress. Conditions for equilibrium. Concept of free body diagram; Introduction to mechanics of deformable bodies.

Unit – 2

Members subjected to flexural loads: Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. Bending stresses, Section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.

Unit – 3

Principal planes, stresses & strains: Members subjected to combined axial, bending & Torsional loads, maximum normal & shear stresses; Concept of equivalent bending & equivalent twisting moments: Mohr's circle of stress & strain. Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.

Unit – 4

Torsion: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Stability of equilibrium: Instability & elastic stability. Long & short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

Unit – 5

Transverse deflection of beams: Relation between deflection, bending moment, shear force and load,

Transverse deflection of beams and shaft under static loading, area moment method, direct integration method: method of superposition and conjugate beam method. Variation approach to determine deflection and stresses in beam.

Elastic strain energy: Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts. Castigliano's theorem. Maxwell's theorem of reciprocal deflections.

a) References

b) Strength of Materials : B.C Poonamia and ramamurtham, Dhanpatrai Publishers Delhi

c) Mechanics of solid : S.H.Crandell, N.C.Dahi and T.J. Lardner, Mc Graw Hill International Edition

d) Strength of Materials: G.H. Ryder, ELBS Publications co ltd

e) Elements of Strength of Material :J.P. Tinnoshnko and G.H.Young, Affiliated East west Press New Delhi

f) Solid Mechanic : GMA Kazmi, Tata Mc-Graw Hill Publishing Ltd., New Delhi Mc Graw Hill Publishing co Ltd New Delhi

MINING GEOLOGY

Course/Paper: 03 BMI -104
BMI Semester-III

Introduction to Geology: its scope and application to engineering problems, Physical Geology, Mineralogy - Determinative properties and occurrence of common rock forming minerals in India, Petrology - Igneous, Sedimentary and Metamorphic rocks; **Structural Geology**: Elementary knowledge of rock deformation and structural characteristics of deformed rocks, strike, dip, folds and faults, their description, classification, Joints, Un-conformities/simple forms of igneous rocks, Dykes, sills, etc., Geological maps and their interpretation, Stratigraphy - Principles of Stratigraphy, Standard Stratigraphic Scale, Indian Stratigraphy; **Economic minerals:** their classification, origin, mode of occurrence, geographical and geological distribution, physical properties and industrial uses and distribution of major metallic and non-metallic mineral deposits of India. Origin and distribution of natural fuels - Coal, Petroleum and natural gas, nuclear fuels

Essential Reading:

1. P. K. Mukherjee, *A Text Book of Geology*, The World Press Pvt. Ltd., 9th Edition, 1982.
2. H. H. Read, *Rutley's Elements of Mineralogy*, CBS Publishers and Distributors, 26th Edition, 1984

Supplementary Reading:

1. P. B. Marland, *Structural Geology*, Prentice Hall of India Pvt. Ltd., 3rd Edition, 1990.
2. D. E. Salisbury & W. E. Ford, *A Text Book of Mineralogy*, Wiley Eastern Limited, 4th Edition, 1992.
3. G.W. Tyrrel, *The Principles of Petrology*, B.I. Publications Pvt. Ltd., 1989.
4. G. B. Mahapatra, *Text Book of Physical Geology*, CBS Publishers and Distributors, 1st Edition, 1990.
5. R. Kumar, *Fundamentals of Historical Geology and Stratigraphy of India*, Wiley Eastern Limited, 1992.

BASIC SURVEYING

Course/Paper: 03 BMI -105
BMI Semester-III

Linear measurements and chain surveying: Errors due to incorrect chain, tape corrections**, Compass surveying:** Use of prismatic compass – dial traverse and adjustments, bearing of a line, local attractions and corrections for bearings, **Theodolites**: Seconds theodolites, micro-optic theodolites, electronic theodolites, temporary adjustments, Measurement of horizontal angles by repetition method and re-iteration method, measurement of vertical angles by general method, **Traverse surveying:** close traverse and open traverse, checks in closed traverse and open traverse, plotting a traverse surveying, consecutive co-ordinates: latitudes and departures, closing error, balancing a traverse, **Omitted measurements**, **Leveling:** Use of dumpy levels, micro-optic levels, quick setting levels, digital levels and leveling staff, temporary adjustments of levels, Reduction of levels by height of instrument method, and rise and fall method, ordinary and precise leveling, differential leveling, profile leveling, reciprocal leveling, Survey errors and their adjustments, **Co-ordinate Calculations**; **Triangulation:** Classification of Triangulation systems, Triangulation figures, Base line measurements; EDM and its application, Surveying by Modern instruments such as GPS & Total Station.

Essential Reading:

1. B. C. Punmia, *Surveying, Vol- I, II, III*, Laxmi Publication, New Delhi, 12th Edition, 1990.
2. W. Schofield and M. Breach, *Engineering Surveying*, sixth edition, ELSEVIER, B&H. 2007,

Supplementary Reading;

1. A. V. Maslov, *Geodetic Surveying*, Mir Publication, Moscow, Revised edition, 1980.
2. B. Fedorov, *Elementary plane and mine surveying*, Mir Publication, Moscow, Revised edition, 1986.
3. V. Natarajan, *Advanced Surveying*, B.I. Publication, Bombay, First edition, 1976.
4. T. P. Kanetkar, *Surveying and Levelling*, Pune vidyarthi Griha Prakashan, Reprints, 1995.
5. S. K. Roy, *Fundamentals of Sueveying*, Prentice Hall of India Pvt., New Delhi, Third Printing, 2004.

MINERAL EXPLORATION

Course/Paper: 03 BMI -106
BMI Semester-III

Classification of ore reserves: proved, probable, and geologist's ore. Geological aspects of drilling borehole location, planning of drilling operations, borehole surveys, correction of deviated boreholes and directional drilling, core-sampling and assaying; **Economic classification of mineral resources**: calculation of in-situ reserves from borehole data. Underground sampling and calculation of blocked reserves; **Exploration**: Theory and application of various methods in mineral exploration, Seismic, Gravity and Magnetic methods Principles and methods of gravity and magnetic prospecting, instrumentation, data processing, interpretation with case studies, Fundamentals of remote sensing and its application in large scale mineral exploration. Exploration for oil and natural gas.

Essential Reading:

1. W. C. Peters, *Exploration and Mining Geology*, Wiley, 2 editions, 1987.
2. P, Kearey, M. Brooks and I. Hill, *An Introduction to Geophysical Exploration*, Wiley-Blackwell; 3rd edition, 2002.

Supplementary Reading;

1. C. J. Moon, M. K. G. Whateley, A. M. Evans and W. L. Barrett, *Introduction to Mineral exploration*, Blackwell Publishing, 2006.
2. R. E. Sheriff and L. P. Geldart, *Exploration Sysmology*, Cambridge University Press; 2 edition, 1995.
3. H. L. Hartman, *SME Mining Engineering Handbook,* Society of Mining and Metallurgy and Exploration (US), 1992, 2394 pages.
4. R. Marjoribanks, *Geological methods in Mineral exploration and Mining*, Springer; 1st edition, 1997.

NUMERICAL METHODS LABORATORY

Course/Paper: 03 BMI -201
BMI Semester-III

Experiments to be handled using FORTRAN/C ++/JAVA

1. Bisection Method
2. Method of False Position and Secant Method
3. Newton-Raphson Method
4. Method of Successive approximation
5. Gaussian Elimination Method
6. Gauss-Seidel Iterative Method
7. Inversion of a Matrix
8. Eigen Values and Eigen Vectors
9. Lagrange’s interpolation
10. Newton’s forward and backward interpolation
11. Everette’s formula
12. Numerical Differentiation
13. Trapezoidal rule of integration
14. Simpson’s one-third rule
15. Simpson’s three-eighth rule
16. Euler’s method
17. Improved Euler’s method
18. Runge-Kutta Second and fourth order methods
19. Predictor-Corrector Methods
20. Taylor Series Method

ELECTRICAL ENGINEERING LABORATORY

Course/Paper: 03 BMI -202
BMI Semester-III

1. Verification of Thevenin‟s Theorem and Superposition Theorem.
2. Voltage Current Relationship and locus diagram of a series R-L Circuit.
3. Measurement of three phase power by two wattmeter method.
4. Testing of single phase energy meter at different power factors.
5. Study of series and parallel resonance circuit.
6. Verification of Reciprocity and Maximum Power Transfer Theorem.
7. Study of Electrical Motors and starters.
8. No-load and Blocked rotor test of three phase Induction Motor.
9. OCC & SCC of a three phase alternator.
10. Speed control of DC motor by varying armature circuit & field circuit method.
11. Magnetization characteristic of DC shunt Motor.
12. Efficiency and Regulation of single phase transformer by open circuit & short circuit test

MINING GEOLOGY & EXPLORATION LABORATORY

Course/Paper: 03 BMI -203
BMI Semester-III

LIST OF EXPERIMENTS:
1. Identification of common rocks
2. Identification of common Minerals
3. Study of physical properties of minerals
4. Determination of strike and dip
5. Identification and stereographic plotting of joints.
6. Study of topographic maps
7. Drawing of geological section
8. Geological maps with folds and faults
9. Study of geophysical exploration equipment - resistivity meter
10. Study of aquameter
11. Study of magnetometer
12. Geological field trips

MECHANICS OF SOLIDS LAB

Course/Paper: 03 BMI -204
BMI Semester-III

1. Izod Impact testing.
2. Rockwell Hardness Testing.
3. Spring Testing
4. Column Testing for buckling
5. Torsion Testing
6. Tensile Testing
7. Compression Testing
8. Shear Testing
9. Brinell Hardness Testing
10. Bending Test on UTM.
11. Study of Fatigue Testing Machine.

Semester IV

MINE SURVEYING

Course/Paper: 04 BMI -101
BMI Semester-IV

Linear measurement, Compass surveying - use of prismatic compass, bearing of a line, dial traverse and adjustments, local attractions and correction of bearings, Theodolites-seconds theodolites, micro-optic theodolites, electronic theodolites, measurement of horizontal angles by repetition method and re-iteration method and measurement of vertical angles by general method; Traversing - surface and underground including boundary surveys and joint surveys, survey errors and their adjustments, co-ordinate calculations.. Leveling- use of dumpy levels, quick setting levels, digital levels and leveling staff, temporary adjustments of levels, ordinary and precise leveling, reduction of levels by height of instrument method and rise and fall method, reciprocal leveling, profile leveling, differential leveling; Triangulation: Classification of Triangulation systems, Triangulation figures, Base line measurements ; Correlation of surface and underground surveys: Verticality of shafts, measurement of depth of shafts, setting out curves - surface and underground. Special Mine Surveys: Surveys for connecting national grid, survey of installations of mine structures, EDM and its application, Surveying by Modern instruments by using GPS & Total Station.

Essential Reading:

1. W. Schofield and M. Breach, *Engineering Surveying*, Sixth edition, 2007, ELSEVIER, B&H.
2. B. C. Punmia, *Surveying, Vol - I, II, III,* Laxmi Publication, New Delhi, 12th Edition, 1990.

Supplementary Reading:

1. A. V. Maslov, *Geodetic Surveying,* Mir Publication, Moscow, Revised edition, 1980.
2. B. Fedorov, *Elementary Plane and Mine Surveying,* Mir Publication, Moscow, Revised Edition, 1986.
3. V. Natarajan, *Advanced Surveying,* B.I. Publication, Bombay, First edition, 1976.
4. T. P. Kanetkar, *Surveying and Levelling,* Pune Vidyarthi Griha Prakashan, Reprints, 1995.
5. S. K. Roy, *Fundamentals of Surveying,* Printice Hall of India Pvt., New Delhi, Third Printing, 2004.

MATHEMATICS – IV

Course/Paper: 04 BMI -102
BMI Semester-IV

UNIT 1 : LAPLACE TRANSFORM - Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficient with special reference to the wave and diffusion equations.
UNIT 2: Classification of partial differential equation. Linear partial differential equation of higher order with constant coefficients, Charpit's method Monges Method
UNIT 3 : Bessel"s functions of first & second kinds, simple recurrence relations, Orthogonal property of Bessel's transformation, Generating functions Legendre's function of first kind, simple recurrence relation orthogonal property,, Generating function.
UNIT 4 : COMPLEX VARIABLES - Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy;s theorem. Cauchy's integral formula.
UNIT 5 : COMPLEX VARIABLES -Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.
Referances

1. Engg Mathematics III Mangal Maheswari ,Dhanpat Rai & co Delhi
2. Engg Mathematics IV Mangal Maheswari ,Dhanpat Rai & co Delhi
3. Differential Calculas: M.D.Raisinghania
4. Engg Mathematics III Dr okharoo & others ,Unique Books Ajmer

ROCK MECHANICS

Course/Paper: 04BMI103
BMI Semester-IV

Introduction: Structural Features of rock material and rock mass ; Physico mechanical properties: Physical and mechanical properties including swelling potential, different strength parameters and their determination, Hydraulic properties of rocks and determination; Elastic and Time dependent properties of rock: Rock Deformability and its measurement. Elastic and non-elastic behavior, influence of time on rock properties; Theories of rock failure: Rock Strength, Analysis of Stress-Strain Curve, Rock failure and different failure criteria. Effect of anisotropy on rock strength; Stress: Fundamentals of stress and strain in two and three dimension, Stress-Strain relationships, Mohr's circle, Rock mass classification Systems and their interpretation, Rock Support and Design.

Essential Reading:

1. R.E. Goodman, *Introduction to Rock Mechanics*, John Wiley and Sons, 1980
2. V.S. Vutukuri and K. Katsuyama, *Introduction to Rock Mechanics*, Industrial Publishing & Consulting Inc., Tokyo, 1994

Supplementary Reading:

1. B.H.G. Brady and E.T. Brown, *Rock Mechanics for Underground Mining*, George Allen and Unwin Ltd., 1992
2. J.C. Jeager and N.G.W. Cook, *Fundamentals of Rock Mechanics*, Chapman and Hall, 1979
3. L. Hartman, *Mining Engineering Handbook*, Society for Mining, Mettalurgy and Exploration Inc., USA, 1992

4. J.A. Hudson and J.P. Harrison, *Engineering Rock Mehcanics*, Pergamon Press, UK,2000

Composition of mine air, Mine gases: properties, origin, occurrence, physiological effects, detection, monitoring and control, Methane layering, Degasification of coal seams. Production, assessment, physiological effects and control of mine dusts ; Thermal environment and psychrometry: Sources of heat load sources in mines, Effect of heat and humidity on miners. Psychrometry, Cooling power of mine air, Methods of improving of cooling power of mine air, Air Conditioning - basic vapour cycle ; Mechanics of air flow through mine openings, Resistance of airways, Equivalent orifice, distribution of air current, control devices in ventilation systems, Natural ventilation: Calculation of NVP, Thermodynamic aspects, Artificial aids to natural ventilation ; Mechanical ventilation: Principal types of mine fans, Installation, operation, characteristics and selection of mine fans, Fan testing and Out put Control, Fan laws and fan drives, Evasees, Diffusers, Booster fans, Auxiliary ventilation. Reversal of air currents and controlled recirculation ; Ventilation Survey: Quantity and Pressure survey ; Planning and Design of Ventilation Systems: mine ventilation design criteria and ventilation design factors, ventilation standards, Ascensional, descensional, homotropal, antitropal, central and boundary ventilations systems, Ventilation layouts for coal and metal mining, Network analysis : Hardy-Cross method, Computer application in mine ventilation.

Essential Reading:

1. M. J. McPherson, *Subsurface Ventilation and Environmental Engineering*, Chapman & Hall, 1993
2. G. B. Mishra, *Mine Environment and Ventilation*, Oxford University Press, Fifth Impression, 1993

Supplementary Reading:

1. H. L. Hartman, *Mine Ventilation and Air Conditioning*, John Wiley, Paperback edition,1989.
2. H. L. Hartman, J. M. Mutmansky, R. V. Ramani and Y. J. Wang, *Mine Ventilation And Air Conditioning*, Wiley-interscience, 3rd Edition, 1997
3. S. P. Banerjee, *Mine Ventilation*, Lovely Prakashan, 1st Edition, 2003
4. M. A. Ramlu, *Mine Disaster and Mine Rescue*, Oxford & IBH, 1991

MINING MACHINERY

Course/Paper: 04 BMI -104
BMI Semester-IV

General: Mechanical transmission of power in mining machinery, shafts, pulleys, gears, and gear/trains, belt drives, chain drives, couplings and clutches, brakes. ; **Wire ropes:** Constructions, examinations, listing and maintenance. ; **Rope and Locomotive haulages:** Direct, main and tail, balanced double drum and endless haulage, gravity haulage, constructional features, power calculation, selection of haulage ropes, haulage tracks and safety appliances, tubs and mine cars, diesel, battery and trolley wire locomotives, tractive effort, ideal gradient, power calculations, exhaust conditioners. ; **Compressor and pumps:** Generation, distribution and use of compressed air in mines, mine pumps, pumping ranges,
and fittings, elements of pipe line transportation. ; **Hydraulics and mining machines:** Power hydraulics, hydraulic circuits, actuators, hydraulic fluids, control of hydraulic power, cutting and mining machines for coal, surface coal/ore handling plant.

Essential Reading:

1. D. J. Deshmukh, *Elements of mining technology*, Vol. 3, Vidyasewa, 3rd ed,1989.
2. N.T. Karlein, *Mine transport*, Orient Longman,1st ed, 1967.

Supplementary Reading:

1. C. F. Statham, *Coal mining practice*, Caxton Eastern, 1st Ed, 1960.
2. R. D. Singh, *Principles and practices of modern coal mining*, New age international, 1st ed, 1997.
3. S. K. Das, *Modern coal mining technology*, Lovely prakashan, 2nd Ed, 1994.
4. M. P. Alexandrov, *Material handling equipment*,MIR,1st ed,1981.

INTRODUCTORY MINING TECHNOLOGY

Course/Paper: 04 BMI -105
BMI Semester-IV

Introduction: Distributions of mineral deposits in India and other countries, mining contributions to civilization, mining terminology, stages in the life of the mine - prospecting, exploration, development, exploitation and reclamation, access to mineral deposit- selection, location, size and shape (incline, shaft and adit),brief overview of underground and surface mining methods. ; **Drilling:** Types of drills, drilling methods, electric, pneumatic and hydraulic drills, drill steels and bits, drilling rigs, and jumbos. ; **Explosives:** Classification, composition, properties and tests, fuses, detonators, blasting devices and accessories, substitutes for explosives, handling and storage, transportation of explosives. ; **Rock blasting:** Mechanism of rock blasting, blasting procedure, and pattern of shot holes. ; **Shaft**
sinking: Ordinary and special methods, problems, and precautions, shaft supports and lining.

Essential Reading:

1. R. P. Pal, *Rock blasting effect and operation*, A. A. Balkema, 1st Ed, 2005.
2. D. J. Deshmukh, *Elements of mining technology*, Vol. 1, Central techno, 7th ed, 2001

Supplementary Reading:

1. B. H. Gary, *Blasting operations*, Mc-graw Hill, 1st Ed, 1981.
2. R. P. Pal, *Blasting in ground excavations and mines*, Oxford and IBH, 1st Ed, 1993.
3. C. P. Chugh, *Drilling technology handbook*, Oxford and IBH, 1st Ed, 1977.
4. R. D. Singh, *Principles and practices of modern coal mining*, New age international, 1st Ed, 1997.
5. S. K. Das, *Explosive and blasting practices in mines*, Lovely prakashan, 1st Ed, 1993.

MATERIAL HANDLING SYSTEMS

Course/Paper: 04BMI106
BMI Semester-IV

Mine hoist: Drum and koepe winders, constructional features, kinematics, torque and power calculation, speed control, safety contrivances, selection of mine winders, cages, skip, suspension gears, headgear structures, cage guides, pit top and pit bottom circuits and layouts; **Conveyors:** Belt conveyor, chain conveyor, cable belt conveyor, shaker conveyor, vibratory conveyor, constructional features and power calculations, selection and application; **Aerial Ropeway:** Mono-cable, bi-cable, twin-cable ropeway, constructional features and power calculations, selection and application; **Scraper Haulage:** Constructional features, applicability, advantages and disadvantages; **Men and material transportation:** Trackless vehicle loaders, shuttle cars, SDL and LHD, special men and materials transport in mines, men riding systems in mines. ;

Essential Reading:

1. M. A. Ramlu, *Mine hoisting*, Oxford and IBH, 1st ed, 1996.
2. D. J. Deshmukh, *Elements of mining technology*, Vol-III, Vidyasewa, 3rd ed,1989

Supplementary Reading:

1. N. T. Karlein, *Mine transport*, Orient Longman,1st ed, 1967
2. S. C. Walker, *Mine winding and transport* (Advances in mining science and technology), Elsevier Science Publishing Company,1st ed, 1988
3. N. Mukherjee, *Materials handling in mines*, Technology mining society IIT Kharagpur, Vol-XI,1sted,1979-80
4. B. Norman, *Mechanics of bulk material handling*, London Butterworths,1st ed,1971
5. M. P. Alexandrov, *Material handling equipment*, MIR,1st ed,1981

MINING MACHINERY LABORATORY

Course/Paper: 04 BMI -201
BMI Semester-IV

LIST OF EXPERIMENTS:

1. Study of jack hammer drill
2. Study of different types of wire rope & their uses
3. Study of different types of rope clips
4. Study of reliance rope capel
5. Study of different types of roof bolts
6. Study of Sylvester prop withdrawal
7. Study of different types of brakes
8. Study of different types of Clutches
9. Study of different parts & functions of an electric coal drill
10. Study of direct rope haulage
11. Study of endless rope haulage
12. Study of main & tail rope haulage

ELECTRONICS LABORATORY

Course/Paper: 04 BMI -202
BMI Semester-IV

1. Familiarization with electronic components, and general purpose Laboratory equipment.
2. Use of CRO and function generator and calculation of amplitude, frequency, time period of different types of ac signals.
3. Verification of Junction Diode and Zener Diode characteristic and determination of static and dynamic resistance at the operating point
4. Verification of input and output characteristics of a Bipolar Junction Transistor and determination of the operating point ad load line.
5. Verification of input and output characteristics of a Field Effect Transistor and determination of the operating point ad load line.
6. Verification of Series and Parallel Resonance theory.
7. Operation of diode as different form of rectifier and effect of different types of passive filters on the output.
8. Determination of frequency response of passive high pass and low pass filters.
9. Determination of frequency response of a RC coupled amplifier and determination of bandwidth and signal handling capacity.
10. Verification of truth table for different types of Logic gates viz. AD, OR, NAND, NOR, NOT, EX-OR with 2/ 3/ 4 inputs.
11. Use of OP-AMP as an inverting and non-inverting amplifier for different gains.
12. Introduction to circuit analysis using p-spice through frequency response study of a RC filter.

ROCK MECHANICS LAB

Course/Paper: 04 BMI -203
BMI Semester-IV

LIST OF EXPERIMENTS:
1. Preparation of Rock Specimens for various testing purposes
2. Study of Compressive Testing Machine
3. Determination of Protodyakonov Strength Index
4. Determination of Impact Strength Index
5. Determination of the Uni-axial Compressive Strength of rock materials
6. To Determine the Tensile Strength of a rock specimen by an Indirect Method (Brazilian Test)
7. Determination of Point Load Strength Index
8. Determination of Shear Strength by Direct Shear Test
9. Determination of Modulus of Elasticity and Poission's ratio of rock samples
10. Determination of Slake Durability Index of rock samples
11. Determination of Slake Durability Index of coal samples
12. Determination of Permeability of rock
13. Determination of C – φ by using Tri-axial Cell Unit
14. Determination of Index Parameter using Schmidth Hammer

MINE SURVEYING LABORATORY

Course/Paper: 04 BMI -204
BMI Semester-IV

LIST OF EXPERIMENTS:

1. Prismatic Compass Surveying: (a) Bearing of the lines (b) Traversing
2. Levelling: (a) Precise Levelling (b) Profile Levelling
3. Plane Table Surveying: (a) Intersection Methods (b) Radiation Method.
4. Theodolite Traversing
5. Theodolite: (a) Horizontal angle measurement (b) Vertical angle measurement.
6. Signs and Conventions used by the GSI, MMR and CMR.
7. Triangulation Survey:(a) By 1" Theodolite (b) By Electronic Theodolite
8. Triangulation Survey (a) By EDM (b) By Total Station
9. Distance Measurement:(a) By EDM (b) By Total Station
10. Coordinate Measurement:(a) By Total Station (b) By GPS
11. Traversing and Recording Position of points by GPS
12. Special Mine Surveys – Surveys for connecting National Grid, Survey of installations of Mine Structures

Semester V

MINE VENTILATION

Course/Paper: 05 BMI -101
BMI Semester-V

Composition of mine air, Mine gases: properties, origin, occurrence, physiological effects, detection, monitoring and control, Methane layering, Degasification of coal seams. Production, assessment, physiological effects and control of mine dusts ; Thermal environment and psychrometry: Sources of heat load sources in mines, Effect of heat and humidity on miners. Psychrometry, Cooling power of mine air, Methods of improving of cooling power of mine air, Air Conditioning - basic vapour cycle ; Mechanics of air flow through mine openings, Resistance of airways, Equivalent orifice, distribution of air current, control devices in ventilation systems, Natural ventilation: Calculation of NVP, Thermodynamic aspects, Artificial aids to natural ventilation ; Mechanical ventilation: Principal types of mine fans, Installation, operation, characteristics and selection of mine fans, Fan testing and Out put Control, Fan laws and fan drives, Evasees, Diffusers, Booster fans, Auxiliary ventilation. Reversal of air currents and controlled recirculation ; Ventilation Survey: Quantity and Pressure survey ; Planning and Design of Ventilation Systems: mine ventilation design criteria and ventilation design factors, ventilation standards, Ascensional, descensional, homotropal, antitropal, central and boundary ventilations systems, Ventilation layouts for coal and metal mining, Network analysis : Hardy-Cross method, Computer application in mine ventilation.

Essential Reading:

3. M. J. McPherson, *Subsurface Ventilation and Environmental Engineering*, Chapman & Hall, 1993
4. G. B. Mishra, *Mine Environment and Ventilation,* Oxford University Press, Fifth Impression, 1993

Supplementary Reading:

5. H. L. Hartman, *Mine Ventilation and Air Conditioning,* John Wiley, Paperback edition,1989.
6. H. L. Hartman, J. M. Mutmansky, R. V. Ramani and Y. J. Wang, *Mine Ventilation And Air Conditioning,* Wiley-interscience, 3rd Edition, 1997
7. S. P. Banerjee, *Mine Ventilation,* Lovely Prakashan, 1st Edition, 2003
8. M. A. Ramlu, *Mine Disaster and Mine Rescue,* Oxford & IBH, 1991

SYSTEM ENGINEERING

Course/Paper: 05BMI102
BMI Semester-V

Introduction: Concept of system engineering, General model selection; Data collection: Data collection methods, time study, work sampling, sample number calculation; System analytical techniques: Statistical methods, control charts – X bar chart, R chart, S chart; Mathematical methods for loading and hauling; Stochastic models: Monte Carlo simulation, Activity oriented simulation, process oriented simulation; Reliability: Concepts of reliability, concept of different distribution: Normal, exponential, Beta, Gamma, Binomial, lognormal etc.; fitting a distribution to data, reliability of series and parallel systems, reliability analysis of a combined series parallel system; Optimization and design: Heuristic technique, Dynamic programming, network flow theory, Graph theory; Programming: Linear programming, transportation and assignment problems, Mixed integer linear programming, queuing theory, network analysis, inventory control and simulation techniques. ; Analysis: Analysis of exploration and mining systems using mathematical programming, simulation techniques and network models; stochastic model simulation; Concept of Artificial Intelligence: Natural language understanding, Machine vision, robotics, expert system.

Essential Reading:

1. Bernel & Krako, *Introduction to System Analysis*, A.A. Balkema, 2004.
2. N. Deo, *System Simulation by Digital Computers*, Prentice Hall of India,2005

Supplementary Reading:

1. W. Donald Boyd, *System analysis and modeling,* Academic Press, 2001.

COMPUTER APPLICATION IN MINING

Course/Paper: 05 BMI -103
BMI Semester-V

Introduction to structure terminology and peripherals, algorithms, flow charts, programs, dedicated systems. ; Application in Mining: Exploration, rock topographic models, bore hole compositing, compositing, ore reserve calculation, interpolation and geostastical models. ; Open pit design: Ultimate pit design, introductory process control, underground mine design: Production scheduling; Operation Simulation: Introduction, Simulation overview, objective, understand the role of modeling, Understanding the basic concept in simulation; Example of simulation in mining aspects: Simulation of machine repair problems, Concepts of variability and prediction, Example with dumping time problem, fitting distribution with chi-square test; Random number generation: Methods of random number generation, Properties of random number, pseudorandom number; Random variates generation: Methods of random variates generation, inverse transformed method, acceptance rejection method, composition method, empirical method and rectangular approximation; Simulation languages: GPSS, SLAM; Logical flow diagram of different mining activities, Coding with GPSS and SLAM of different mining problems; Computer Control: Remote control, automatic control, application and limitations of control.

Essential Reading:

1. T. C. Bartee, *Digital Computer Fundamentals*, Mc GRAW HILL, 4th Ed., 1984.
2. P. Malvino and D. P. Leach, *Digital principles and application*, McGraw-Hill, 5th Ed., 1994

Supplementary Reading:

1.R.V. Ramani, *Application of computer methods in the mineral industry*.

SURFACE MINING TECHNOLOGY

Course/Paper: 05BMI104
BMI Semester-V

Introduction: Applicability and limitations, Stripping Ratio, Preliminary evaluation of surface mining projects. ; Surface Mining Methods: Development of Mineral deposits by opencast mining, design and layout of opencast mines. Methods of stripping, Bench geometry, Bench slope. Drilling, blasting, loading and transportation in opencast mines, Equipment used for different operations, Choice and their application. ; Placer Mining and Sea bed Mining: Ground sluicing, Hydraulicking and Dredging. Exploitation systems of ocean mineral resources. Relevant provisions of coal mines and metalliferous mines regulations. ; Environmental problems due to surface mining and their remedial measures, Recent developments in the deployment of heavy earth moving machineries in the surface mines.

Essential Reading:

1. G. B Mishra, *Surface Mining*, Lovely prakashan Dhanbad, 2nd ed,2006.
2. K Raj. Singhal, *Mine Planning and Equipment Selection*, A. A. Balkema Rotterdam,1st ed,1995.

Supplementary Reading:

1. S. K. Das, *Surface Mining Technology*, Lovely prakashan Dhanbad, 1st ed,1994.
2. V. V. Rzhevsky, *Opencast Mining Unit operations*, Mir Pub., Mascow, 1985.
3. W. Hustrulid and M. Kuchta, *Open pit mine planning and Design*, Vol-I, A.A. Balkema Rotterdam,1st ed,1995.
4. Rozgonyi, G Tibor, *Continuous surface Mining*, A.A. Balkema Rotterdam,1st ed,1988.
5. Crawford, T. John, *Open pit mine planning and Design*, American Institute of Mining, Metallurgical and Petroleum Engineers,1979.

MINERAL PROCESSING TECHNOLOGY

Course/Paper: 05BMI105
BMI Semester-V

General Principle: Mineral Beneficiation and its role in mineral exploitation. ; **Comminution and Liberation** : Theory and practice of crushing and grinding, performance and choice of crushers and grinding mills. Laboratory techniques, interpretation and plotting of date, Industrial screens and screening efficiency; **concentration:** Theory and practice of classification, classifiers- Their performance and choice, Picking and washing techniques. Theory and application of sink and float, jigging and flowing film concentration- methods and equipment used; **Froth Flotation:** Physico-chemical principles, flotation reagents, flotation machines and circuits, application to common sulphides, oxides and oxidized minerals. Electrostatic and Electro-magnetic Separation - Principles, operations and fields of applications. ; **Flow Sheets:** Simplified flow sheets for the beneficiation of beach sand, coal and typical ores of copper, lead, zinc and manganese with special reference to Indian deposits.

Essential Reading:

1. A. M. Gaudin, *Principles of Mineral Dressing*, Tata McGraw & Hill,1939
2. R. H. Richard and C. E. Locky, *A text Book on Ore Dressing*, A A Balkema,2004

Supplementary Reading:

1. A. F. Taggart, *Mineral Dressing Handbook*,P&H,2000
2. B.A. Wills, *Mineral Processing Technology*, Willy & Sons,2005
3. G. C. Lowrison, *Crushing & Grinding*, Maxwell and MacMillan,2002
4. L. Svalovsky, *Solid Liquid Separation*, Tata McGraw & Hill Inc.,2003

SOLID WASTE MANAGEMENT

Course/Paper: 05BMI106
BMI Semester-V

Classification & characterization of waste, collection, Handling of Industrial (Mining, Thermal, Chemical, Radioactive, Biomedical, etc.) and Domestic Waste, Utilisation of wastes, ; Federal and State regulations on Waste Management, Recycling, Recovery and Reuse of Wastes, Optimisation of waste Disposal System. ; Global Scenario in Waste Management.

Essential Reading:

1. M. L. Davis and W. A. Eornwell, *Introduction to Environmental Engineering*, McGrow Hill Publishing Co, NY
2. G. N. Pandey & G. C. Carney, *Environmental Engineering*, 1st edn. Tata McGraw-Hill, New Delhi, India

Supplementary Reading:

1. *Hazarding waste Rules*, 1989
2. James H. Saling, W Andson, Y.S Fertiman, *Radioactive Waste Management*, Tayler & Francis Group 2nd edition

MINE VENTILATION LABORATORY

Course/Paper: 05BMI 201
BMI Semester-V

LIST OF EXPERIMENTS:

1. Determination of Relative Humidity of Mine air with Fixed/stationary Hygrometer, and Whirling Hygrometer
2. Determination of Relative Humidity of air using Assman Psychrometer
3. Determination of cooling power of air using Kata Thermometer
4. Determination of CO% by MSA CO detector
5. Determination of percentage of CO and CO2 by Drager Multi Gas Detector (Model 21/31).
6. Determination of Methane % by MSA D-6 Methanometer.
7. Study of the construction and working of Flame Safety Lamp (VELOX GL-50, GL-60 and MSA type)
8. Gas Testing by Flame Safety Lamp in a Gas Testing Chamber
9. Measurement of Air Velocity by (i) Vane Anemometer (ii) Electric Analog Velometer
10. Study of Pitot Static Tube & measuring of Air Velocity in a ventilation duct in combination with an Inclined Manometer.
11. Measurement of dust concentration by (i) Gravimetric Dust Sampler, (II). Personal Dust Sampler
12. Measurement of dust concentration by High Volume Sampler
13. Measurement of Noise Level by Integrating Sound Level Meter (CEL-283)

MINERAL PROCESSING TECHNOLOGY LABORATORY

Course/Paper: 05 BMI -202
BMI Semester-V

LIST OF EXPERIMENTS:

1. Particle size analysis of different rocks and minerals.
2. Study of Jaw Crusher
3. Determination of Actual Capacity and Reduction Ratio of jaw crusher
4. Verification of Rettinger's Law using jaw crusher,.
5. Study of Hammer Mill
6. Determination of Actual Capacity and Reduction Ratio of Hammer Mill
7. Verification of Kick's' Law using Hammer Mill
8. Study of the effect of Ball Load and time on Grinding using Ball Mill
9. Study of Vibrating Screen and Determination of its Effectiveness.
10. Study of Magnetic Separator and Determination of its Efficiency
11. Study of Baum Jig and Determination of its Efficiency.

MATERIAL HANDLING SYSTEMS LABORATORY

Course/Paper: 05 BMI -203
BMI Semester-V

LIST OF EXPERIMENTS:
1. Study of bi-cable aerial rope-way
2. Study of headgear and pulleys
3. Study of cage & skip
4. Study of different types of keps
5. Study of scraper chain conveyor
6. Study of belt conveyor
7. Study of gate end box
8. Study of king detaching safety hook
9. Study of mechanism of shaft sinking
10. Study of winding shaft
11. Study of safety devices in haulage
12. Study of cage attachment to winding rope

COMPUTER APPLICATION IN MINING LAB

Course/Paper: 05 BMI -204
BMI Semester-V

Introduction to structure terminology and peripherals, algorithms, flow charts, programs, dedicated systems. ; Application in Mining: Exploration, rock topographic models, bore hole compositing, compositing, ore reserve calculation, interpolation and geostastical models. ; Open pit design: Ultimate pit design, introductory process control, underground mine design: Production scheduling; Operation Simulation: Introduction, Simulation overview, objective, understand the role of modeling, Understanding the basic concept in simulation; Example of simulation in mining aspects: Simulation of machine repair problems, Concepts of variability and prediction, Example with dumping time problem, fitting distribution with chi-square test; Random number generation: Methods of random number generation, Properties of random number, pseudorandom number; Random variates generation: Methods of random variates generation, inverse transformed method, acceptance rejection method, composition method, empirical method and rectangular approximation; Simulation languages: GPSS, SLAM; Logical flow diagram of different mining activities, Coding with GPSS and SLAM of different mining problems; Computer Control: Remote control, automatic control, application and limitations of control.

Essential Reading:

1. T. C. Bartee, *Digital Computer Fundamentals*, Mc GRAW HILL, 4th Ed., 1984.
2. P. Malvino and D. P. Leach, *Digital principles and application*, McGraw-Hill, 5th Ed., 1994

Supplementary Reading:

1. R.V. Ramani, *Application of computer methods in the mineral industry*.

Semester VI

MINE ENVIRONMENTAL ENGINEERING

Course/Paper: 06 BMI -101
BMI Semester-VI

Spontaneous Heating and Mine Fires: Spontaneous Heating : Causes, incubation period, detection, remedial measures.Mine Fires -Classification, causes, preventive measures, dealing with mine fires - direct and indirect methods, reopening of scaled off areas. ; Explosion: Fire-damp Explosion - Limits of inflammability of methane, causes of ignition, nature of fire damp explosion, propagation and prevention. Coal-dust Explosion - Index of inflammability, factors affecting explosibility of coal dust, causes and safeguards. Propagation of coal dust explosions, Investigation after an explosion. ; Mine Illumination: Its effects on safety, efficiency and health, Flame and electric safety lamps- their uses and lamp-room - lay out and organization, standards of illumination in mines, lighting from the mains, photometric illumination survey, Miners' diseases

Essential Reading:

1. M. A. Ramlu, *Mine Disaster and Mine Rescue*, Oxford & IBH, New Delhi, 1991
2. Rakesh and Lele, *Water Problem in Mines*, Mrs. Ashalata, Varanasi, 2003

Supplementary Reading:

1. A.T. Donalad, *The lighting of Underground* Mines,Trans Tech Switzerland,1982
2. R. Mcadam and D. Davidson, *Mine Rescue Work*, Oliver and Boyd, London, 2000

UNDERGROUND MINING TECHNOLOGY

Course/Paper: 06 BMI -102
BMI Semester-VI

Development of Stratified Deposits: Choice of mine size, methods of entry and primary development. ; Underground Coal Mining Methods: Classification and choice, Bord and Pillar mining, development and extraction, Long-wall mining, face mechanization, production equipment and face machinery used, viz. coal cutting machines, drills, mechanical loaders, LHDS, shuttle car etc. - their performance and choice. Special coal mining methods. ; Underground Metal Mining Methods: General Development of property level, crosscuts, raises and winzes, drifting and tunneling, U/g metalliferrous mining methods - their classification and choice. Stoping of ore bodies, supporting and development of stopes Special techniques of mining mechanization. Mining equipment and production machine used below ground. Provision of MMR 1961. ; Supports: Roadway and face supports, supports for junctions and special conditions, setting and withdrawal of supports, roof bolting, roof stitching, systematic supporting, protective of pillars. ; Stowing and Filling Methods, gathering and transportation arrangements, stowing plants and layout. Provision of CMR 1957.

Essential Reading:

1. T. N. Singh, *Underground winning of Coal,* Oxford and IBH New Delhi,1992
2. Y. P. Chacharkar, *A study of Metalliferous Mining Methods,* Lovely prakshan Dhanbad,1994

Supplementary Reading:

1. I.C.F. Statham, *Coal Mining Practice,* Caxton eastern agencies,Calcutta,Reprint,1964
2. D.J. Deshmukh, *Elements of Mining Technology,* Vol - I & II ,EMDEE publishers Ranchi, Revised edition,2000
3. S. K. Das, *Modern Coal Mining Technology,* Lovely prakshan Dhanbad,1992
4. R. D. Singh, *Principles & Practices of Modern Coal Mining,* New age international New Delhi,1997
5. B. C. Arthur, *SME Mining Engineers Hand Book,* American Institute of Mining, Metallurgical and Petroleum Engineers New York, 1973

GEOMECHANICS

Course/Paper: 06 BMI -103
BMI Semester-VI

Rock Stress: Stresses around mine openings of different cross-sections, Insitu Stress- Determination of insitu rock mass properties, insitu testing methods and instrumentations. ; **Design of underground workings:** Pillar Design including applicability of Wilson's approach, Safety factors; **Slope Stability:** Slope failure types, mechanisms and theories. ; **Rock Reinforcement and Support:** Mechanisms of failure in rock structures-intact and anisotropy, Rock Load and stability, Supporting and reinforcement members, Design of support and reinforcement systems; **Mine Subsidence:** Subsidence mechanisms and control measures, Basics of numerical methods in geomechanics and applications

Essential Reading:

1. R.E. Goodman, *Introduction to Rock Mechanics*, John Wiley and Sons, 1980
2. V.S. Vutukuri and K. Katsuyama, *Introduction to Rock Mechanics,* Industrial Publishing & Consulting Inc., Tokyo, 1994

Supplementary Reading:

1. B.H. G. Brady and E.T. Brown, *Rock Mechanics for Underground Mining*, George Allen and Unwin Ltd., 1992
2. J.C. Jeager and N.G.W. Cook, *Fundamentals of Rock Mechanics*, Chapman and Hall, 1979
3. L. Hartman, *Mining Engineering Handbook*, Society for Mining, Metallurgy and Exploration Inc., USA, 1992
4. E. Hoek and J. Bray, *Rock Slope Engineering*, 3rd Ed., Inst. Of Mining and Metallurgy, London, 1980
5.J.A. Hudson, *Comprehensive Rock Engineering*, Pergamon Press, UK,2000

GROUND CONTROL INSTRUMENTATION

Course/Paper: 06 BMI -104
BMI Semester-VI

Deformation and Strain Measuring Instruments: Convergence meters, convergence recorders, tape extensometers, bore hole deformation, gauge, multipoint borehole extensometers and bore hole camera ; **Load and Pressure Measuring Instruments:**Load cells, pressure measuring instruments – stress capsules, stress meters, borehole pressure,cells and flat jacks. Strain gauges and transducers, readout units, sensors, transmitters and data acquisition systems ; **Testing Equipment:** UTM, MTS and acoustic emission equipment. Rock bolt pull tester, Monitoring and interpretation of the data ; **Applications:** Mining Engineering applications: Instrumentation in underground mines and opencast mines; Civil Engineering applications; Instrumentation in Hydro electric projects and Tunnels, case studies.

Essential Reading:

1. J. A. Hudson, *Comprehensive Rock Engineering*, Pergamon Press, UK,2000
2. M. L. Jeremic, *Strata Mechanics in coal mining*, A A Balkema, Rotterdam, Taylor and Francis, 1985,

Supplementary Reading:

1. Z. T. Bieniawski, *Strata Control in Mineral Engineering*, New York: John Wiley & Sons, 1987.
2. B. H. G. Brady and E.T. Brown, *Rock Mechanics for Underground Mining*, George Allen and Unwin Ltd., 1992
3. Z.T. Bieniawski. *Engineering Rock Mass Classifications*. Wiley, New York, 1989

REMOTE SENSING AND ITS APPLICATION

Course/Paper: 06 BMI -105
BMI Semester-VI

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Elements of photogrammetry, Stereoscopic Vision, Photo interpretation techniques, Definition and components of remote sensing, Electromagnetic waves and radiation principles, Multiconcept remote sensing, interaction of EMW with various ground components: vegetation, water, snow, soil and minerals; Sensors and platforms, False color composite, Digital image processing: geometric and radiometric correction, image enhancement, band ratio, edge detection, filtering, principal component analysis, and image classification, Normalized difference vegetation index, Application of remote sensing in hydrology, mineral exploration, natural hazards like landslide, flood, and earthquake, Identification of surface feature, drainage pattern, structural patterns.

Essential Reading:

1. T.M. Lillesand, R.W. Kiefer, J.W. Chipman, *Remote Sensing and Image Interpretation*, John Wiley and Sons, 2004.
2. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, Addison-Wesley Publishing Company, 1992.

Supplementary Reading:

1. S. N Pandey, *Principle and Application of Photogeology*, Wiley Eastern Limited, 1987.
2. R.P Gupta, *Remote Sensing Geology*, Springer, 2003.
3. S.A. Drury, *A Guide to Remote Sensing: Interpreting Images of the Earth*, Oxford University Press, Oxford, 1990.
4. B.Tso, P.M Mather, *Classification Methods for Remotely Sensed Data*, Taylor &

MINE ECONOMICS

Course/Paper: 06 BMI -106
BMI Semester-VI

Examination of Mineral properties, Mine sampling, estimation of reserves and grades, Impurities and quality control, commercial uses of minerals and ores; Mine valuation. Depreciation methods; decision trees, Mineral Industry of India, ; National Mineral Policies, conservation, taxation, trading, mining entrepreneurship, Principles of company law, shares and debentures; joint stock company and public company; partnership business, capital formation, ABC analysis and break-even analysis, budgetary control, wages and incentives, purchases, stores and inventory control, sales and despatches.

Essential Reading:

1. R.T. Deshmukh, *Mineral and Mine Economics*, Myra Publ., Nagpur,1986
2. R.K. Sinha and N.L. Sharma, *Mineral Economics*, Oxford & IBH Pub., 3rd ed,1970

Supplementary Reading:

1. O.P.Khanna, *Industrial Engineering and Management*, Dhanpat Rai Delhi,1993
2. R.N.P.Arogyaswamy, *Courses in Mining Geology*, Oxford and IBH Pub.,2nd ed,1973
3. S. Krishnaswamy, *India's Mineral Resources*, Oxford & IBH pub., 2nd ed,1972
4.P. K.Jain, *Financial management*, Tata McGraw Hill,1981

MINE ENVIRONMENTAL ENGINEERING LABORATORY

Course/Paper: 06 BMI -201
BMI Semester-VI

LIST OF EXPERIMENTS:

1. Study of MSA type Gas mask (Model: "SW", Air purifying filter).
2. Study of MSA type Self Rescuer (Model: IW-65).
3. Study of Oxygen Self Contained Breathing Apparatus i. By Drager BG-174, ii. By Travox-120
4. Study of Drager Pulmotor (Model: PT-60).
5. Study of Portable Fire Extinguishers
6. Study the construction and working of Explosion Proof Fire Stoppings.
7. Determination of susceptibility of coal by chemical method or by puff temperature method.
8. Study of stone dust barrier
9. Determination of flammability temperature of coal by using inflammability index apparatus
10. Study of layout of a self service type Lamp-room.
11. Measurement of Noise Level by Integrated Sound Level Meter (Model: CEL-283EX)
12. Measurement of Lux by Light Meter

GEOMECHANICS LABORATORY

Course/Paper: 06 BMI -202
BMI Semester-VI

LIST OF EXPERIMENTS:
1. Study of Universal Testing Machine
2. Evaluation of ground vibration using Blastmate
3. Determination of Explosive Strength by V.O.D.Monitor
4. Determination of rock hardness by Hardness Tester
5. Determination of Rock In-situ Stress by Flat Jack Unit
6. Determination of the relation between the moisture content and the dry density of the loose rock materials using light compaction
7. Study of Bore hole stress meter
8. To study the Permeability characteristics of coal specimens
9. Determination of crushing strength of rock, slag, aggregate gravel by using LOS Abrasion Testing Machine
10. Determination of Aggregate impact value of rock/ concrete by using Aggregate Impact Test Apparatus
11. Determination of Impact Strength with Pendulum Impact Tester
12.Introduction to a few numerical modeling software's etc.

MODEL PREPARATION LABORATORY

Course/Paper: 06 BMI -203
BMI Semester-VI

LIST OF EXPERIMENTS:
1. Preparation of surface mining models
2. Preparation of underground coal mining models
3. Preparation of underground metal mining models
4. Preparation of underground mine ventilation models
5. Preparation of underground transport models
6. Preparation of underground excavation models
7. Preparation of underground man riding models
8. Preparation of underground support models
9. Preparation of opencast bench models
10. Preparation of reclamation models
11. Preparation of models on blasting in opencast mines
12. Preparation of models on blasting in underground mines

SIMULATION AND MODELING OF MINING SYSTEMS LABORATORY

Course/Paper: 06 BMI -204
BMI Semester-VI

LIST OF EXPERIMENTS:

1. Simulation of underground openings-2D continuum models
2. Simulation of underground openings-3D continuum models
3. Simulation of underground openings- discontinuum models
4. Study of stability of underground opening – Mohr-Coulomb model
5. Study of stability of underground opening – Hoek-Brown model
6. Simulation of opencast workings
7. Study of stability of slopes – 2D continuum models
8. Study of stability of slopes – 3D continuum models
9. Study of stability of slopes – 2D discontinuum models
10. Design of supports for underground openings
11. Simulation of thick seam workings
12. Simulation of multiple seam work

Semester VII

ADVANCED SURFACE MINING

Course/Paper: 07 BMI -101
BMI Semester-VII

Introduction, Indian context of advance surface mines, Advancement in mine unit operation. ; Planning of surface mines viz, Procedural steps of planning, Ore body description, Mining Systems, Ultimate pit configuration. Design of surface mines, Feasibility Report & Detailed Project Report, Modern surface mining equipments. ; Legislations related to surface mining, Mine Closure Planning.

Essential Reading:

1. R. T. Desmukh, *Opencast Mining*, Lovely prakashan Dhanbad, 1st ed, 1990.
2. S. K. Das, *Surface Mining Technology*, Lovely prakashan Dhanbad, 1st ed, 1994.

Supplementary Reading:

1. G. B. Mishra, *Surface Mining*, Lovely Prakashan Dhanbad, 1st ed, 1971.
2. E. Hoek and J. Bray, *Rock Slope Engineering*, 3rd Ed., Inst. Of Mining and Metallurgy, London, 1980
3. W. Hustrulid and M. Kuchta, *Open pit mine planning and Design*, Vol - I, A. A. Balkema Rotterdam, 1st ed,1995.
4.B. Cummins Arthur, *SME Mining Engineers Hand Book*, American Institute of Mining,Metallurgical and Petroleum Engineers New York,1973

MINE LEGISLATION AND SAFETY ENGINEERING

Course/Paper: 07 BMI -102
BMI Semester-VII

Mine Legislation: General principles of Mining Law, Principal Provisions of Mines Act, Mines and Minerals (Regulation and Development) Act, Mineral Concession Rules, Mines Rules 1955, Electricity Rules, Industrial Disputes Act. 1947, Mine Rescue Rules. ; Mine Safety : Accidents- Their causes and prevention, accident statistics, rates of accidents, relation between accidents and efficiency, accident reports, cost of accidents. ; Safety risk assessment and management, Safety Audit, Occupational health and safety in mines. Mine safety management systems, Safety education and training.

Essential Reading:

1. B. K. Kejriwal, *Safety in Mines,* Lovely Prakshan Dhanbad, 2002
2. Rakesh and S. D. Prasad, *Legislation in Indian Mines: A critical appraisal, Vol- I & II,* Mrs Asha Lata Varnasi,5th ed,1990

Supplementary Reading:

1. V. K. Malhotra, *Mineral Concession Rules-1960,* Malhotra Bros.,Patna, Supplementary Ed., 1993
2. A. K. Ghosh, S. K. Ray and A. K. Patra, *Proceeding of the National Seminar on Policies, Statutes & Legislation in Mines,* CIMFR, Dhanbad, India, 2008
3. R. S. Rao, *Law of Mines and Minerals,* S. N. Hussainy (Revised), Asia Law House, 8th Eds, 1996.

INDUSTRIAL MANAGEMENT

Course/Paper: 07 BMI -103
BMI Semester-VII

Management Concept, Principles and Functions of Management, Evaluation of Scientific Management ; Forms of Industrial Organization Structure, Authority, Responsibility, and Span of Control, Factors affecting Span of Control, delegation of authority ; Types of industrial Ownership, Formation of companies, Authorized Capital, Shares, Debentures, Bonds and Sources of Finance, Introduction to balance sheet and profit and loss statement ; Engineering Economics – Break Even Analysis, Interest Calculation, Depreciation, Choosing of alternatives ; Materials management – Functions, Objectives, Purchasing Procedure, Inventory Management, EOQ, ELS, Discount and Shortage Models, Inventory Classification Models viz., ABC, VED analysis etc, Introduction to MRP, JIT, OPT and ERP ; Marketing Management: Selling concept v/s Marketing Concept, Marketing Mix, Marketing function ; Time and Motion study – Procedures, Process Chart, Multiple Activity chart, SIMO Chart, Standard Time, Normal Time, Rating factor, Work sampling ; Personnel Management: Functions of Personnel Management, wages and incentive Plans, Job Evaluation, Merit Rating ; Productivity – Concepts, Total and Fractional Productivity Indices, Types of Wastes, Waste Elimination Techniques, Productivity Cycle ; Quality management – Quality costs, Definition of T Q M, Leadership, Motivation, Seven tools of Quality, Participatory Approaches, Quality Function Deployment, Value Analysis, International Quality Systems, ISO Registration Procedure and Implementation strategies, Intellectual property Rights, ISO 9000 and 14000.

Essential Reading:

1. O.P. Khanna, *Industrial Engineering and Management*, Khanna publishers, New Delhi.
2. Dr. K.C. Arora, *TQM and ISO 14000*, S. K. Kataria & Sons, New Delhi.

TUNNELING

Course/Paper: 07 BMI -104
BMI Semester-VII

Design of tunnels: Rock mass classification, stability analysis of tunnels, elastic and plastic deformation; **Ground control:** stress conditions, behavior of ground, Geomechanics instrumentation, design of supports ; Equipments, Tunnel Boring Machines, ventilation, tunnel economics.

Essential Reading:

1. Richard E Bullock, *Tunneling and Underground Construction Techniques*, SME Publication, 2002
2. Stack Barbara, *Hand book of Mining & Tunneling Machinery*, John Wiley and Sons.

Supplementary Reading:

1. R. V. Proctor, *Rock Tunneling with Steel Supports*
2. F. O. Franciss, *Weak rock tunneling*, Taylor and Francis, 1994
3. J. Johansen, *Modern trends in tunneling and blast design*, Taylor and Francis, 2000
4. F. D. Davidson, *Tunneling and Transport*, Elsevier APPLIED Science, 1987
5. Bieniawski Z.T, *Rock Mechanics Design in Mining & Tunneling*
6. Edi Bickel J. O., T. R. Kuesel & E. H. King, *Tunnel Engineering Handbook*

ADVANCED COAL MINING

Course/Paper: 07 BMI -105
BMI Semester-VII

Extraction of thick seams: Problems and issues, recent experimental trials Chirimiri caving Method, Blasting Gallery Method, Integral Caving method, Sublevel caving method, Hydraulic Mining, Shield Mining ; **Extraction underneath surface features:** Non-Effective width (NEW) , Back filling methods, Wide stall mining. ; Extraction of multiple seams: Problems and issues, recent experimental trials, Parting failures and control, design of workings ; **Extraction of locked up pillars:** Status of Bord and pillar mining in India, techniques of extraction and future requirements ; **Support systems:** Strata behavior at greater depths, problems of strata control in high horizontal stress fields, design of support system.

Essential Reading:

3. R. D. Singh, *Principles & Practices of Modern Coal Mining*, New age international New Delhi,1997
4. T. N. Singh, *Underground winning of Coal*, Oxford and IBH New Delhi,1992

Supplementary Reading:

1. D. J. Deshmukh, *Elements of Mining Technology*, Vol - I, EMDEE publishers Ranchi, Revised edition, 2000.
2. S. K. Das, *Modern Coal Mining Technology*, Lovely prakashan Dhanbad,1992
3. S. P. Mathur, Coal Mining in India, M.S. Enterprises Bilaspur,1999

MINE PLANNING-I

Course/Paper: 07 BMI -106
BMI Semester-VII

Principles of Mine Planning: Mining industry in comparison to other industries, Planning for mineral policy, Plans to be maintained in the mineral industry, Stages of planning of new mines, requirements of planning, Master Plan, Feasibility Report, Detailed project report ; Technical considerations in Planning: Selection of method of mining, opening up of open cast mines and underground mines, development of open cast mines and underground mines, Division of mine lease area into mining Units, location of entries, Surface layouts , pit bottom layout,Ventilation planning .

Essential Reading:

1. S. P. Mathur, *Mine Planning for Coal*, M.G. Consultants, Bilaspur, 1993
2. J. Bhattacharya, *Principles of Mine Planning*, Allied Publishers Pvt Limited, New Delhi, 2003

Supplementary Reading:

1. W. Hustrulid and M. Kuchta, *Open Pit Mine Planning and Design*, A.A.Balkema Rotterdam, 1995
2. B. M. Vorobjev and R.T. Desmukh, *Advanced Coal Mining Vol-II*, Asia Publishing house London,revised edition,1966
3. PWJ Van Rensbarg, *Planning Open-pit mines*, AA Balkema Cape Town, 1970
4. A.A. Myasnikov, *Principle of Coal Mine Ventilation Planning*, N.T.I.S. ,1981.

R D Singh, *Principles and Practices of Modern Coal Mining*, New age International Pvt limited Publishers, New Delhi, 1998

MINOR PROJECT

Course/Paper: 07 BMI -201
BMI Semester-VII

PRACTICAL TRAINING AND INDUSTRIAL VISIT

Course/Paper: 07 BMI -202
BMI Semester-VII

Industrial visit (20 marks) is for the duration of 10 days at the end of V semester and Practical Training (80 marks) is for the duration of 30 days at the end of VI semester. Both will be evaluated during the VII semester.and accordingly grade point will be awarded

Semester VIII

MINE PLANNING-II

Course/Paper: 08 BMI -101
BMI Semester-VIII

Planning of mine workings and systems: infrastructure planning, production planning, Mineral handling plant, optimal planning, Planning of special methods of Coal and metal mines, Placer Mining, Sea bed Mining. ; Socio-Economic considerations: Social aspects, Environment Management Plan, estimation of mining costs and profits, Restructuring planning, Issues and challenges of Mine planning in the future, Mine Closure plan.

Essential Reading:

3. S. P. Mathur, *Mine Planning for Coal,* M.G. Consultants, Bilaspur, 1993
4. J. Bhattacharya, *Principles of Mine Planning,* Allied Publishers Pvt Limited, New Delhi, 2003

Supplementary Reading:

5. W. Hustrulid and M. Kuchta, *Open Pit Mine Planning and Design,* A.A.Balkema Rotterdam, 1995
6. B. M. Vorobjev and R.T. Desmukh, *Advanced Coal Mining Vol-II,* Asia Publishing house London,revised edition,1966
7. PWJ Van Rensbarg, *Planning Open-pit mines,* AA Balkema Cape Town, 1970
8. A.A. Myasnikov, *Principle of Coal Mine Ventilation Planning,* N.T.I.S. ,1981.
9. R D Singh, *Principles and Practices of Modern Coal Mining,* New age International Pvt limited Publishers, New Delhi, 1998

ADVANCED METALIFERROUS MINING

Course/Paper: 08 BMI -102
BMI Semester-VIII

Methods: Techno-economic analysis on choice of stoping methods, high productivity methods: blasthole stoping, vertical retreat method of mining, block caving, raise stoping, underground bench blasting, stope design and production planning in the various methods of stopping ; **Special underground excavations:** shaft pockets, ore bins, ore transfer, ramp, decline, step mining methods, stope fills: preparation, transportation and filling operation, stope design and production planning, methods of pillar extraction, solution mining: in situ leaching, underground retorting, under-sea mining, introduction to novel mining methods, Special underground excavation and system of supports ; **Pillar extraction:** methods of pillar extraction, salt, potash and sulphur mining- their special problems.

Essential Reading:

1. Y. P. Chacharkar, *A study of Metalliferous Mining Methods*, Lovely prakshan Dhanbad,1994
2. K. S. Stout, *Mining Methods and Equipment*, McGraw hill New York,1980

Supplementary Reading:

1. B. C.Arthur, *SME Mining Engineers Hand Book*, American Institute of Mining, Metallurgical and Petroleum Engineers New York, 1973.
2. D.J. Deshmukh, *Elements of Mining Technology*, Vol - II ,Central Techno Publications, Nagpur, 2001
3. *Metal Mines Regulations-1961*, Lovely Prakashan

ENVIRONMENTAL POLLUTION AND CONTROL IN MINES

Course/Paper: 08 BMI -103
BMI Semester-VIII

General: Environmental issues in Mineral Industry- National and Global, Environmental impacts of Mineral exploitation - in underground and opencast mining. ; **Land Environment:** Subsidence, visual impacts, landscape pollution, land degradation, land reclamation, land use, landscape planning, ecology. ; **Societal Development:** Socio-economic impacts, sustainable development, concept of carrying capacity based planning; **Pollution:** Water - Availability, quality, pollution and treatment, Liquid effluents: Quality, treatment and disposal. Solid Wastes - Generation, treatment and disposal, hazardous waste management and planning. Tailings disposal & treatment systems. Air: Pollution, monitoring and Control. Noise and Ground vibration - Causes, precautions, prevention and reduction. ; Environmental Management Plan (EMP), Environmental Impact Statement (Environmental Impact Assessment (EIA), Environmental Legislation in India. Environmental Audit of Mining EIS) projects.

Essential Reading:

1. Chaudhuri and B. D. Nag, *Introduction to Environmental Management*, Interprint New Delhi, 1983.
2. T. N. Khashoo, *Perspectives in Environmental management*, Oxford and IBH New Delhi, 1987.

Supplementary Reading:

1. B. B. Dhar and D. N. Thakur, *Proceedings of the first World Mining Environment* Congress, Taylor and Francis, 1996.
2. R. C. Gupta, *Proceeding of the International Conference on Environmental Management in Metallurgical industries (EMMI-2000).*

SAFETY ENGINEERING

Course/Paper: 08 BMI -104
BMI Semester-VIII

Safety concepts, Functions and role of safety, Fundamentals of loss control, Safety costs - Direct and indirect costs of accidents, Influence of environment on safety (noise, lighting, temperature, humidity). System Engineering Approach to Safety, Causes of Accidents, Accident Analysis and Control, Techniques used in Safety analysis ; Safety Management and Organization, Safety Committee, Role of supervisors, Policy, Operator error, qualitative error predictions, accountability - Fault tree analysis, Operating hazards analysis, Risk assessment, Safety analysis programme, Training, Human Behavioral Approach in Safety. ; Law of safety progress, Regulatory agencies and statute laws Statute law vs Common law, occupational safety and health agency.

Essential Reading:

1. R. A. Stephans, *System safety for the 21st century*. Hoboken, NJ: Wiley-Interscience, 2004
2. N. J. Bahr, *System Safety engineering and risk assessment: A practical approach*, Taylor and Francis, 1997

Supplementary Reading:

1. A. Kuhlmann, *Introduction to Safety Science*, Springer Verlag, 1981
2. Ridley, John & Channing, John, *Safety at Works*, Oxford, 1999
3. Re Velle, B. Jack, *Safety Training Methods*. John Wiley, 1980
4. H. E. Roland and B. Moriarty, *System Safety engineering and management*, Wiley Interscience., 1990.

ECO-FRIENDLY MINING

Course/Paper: 08 BMI -105
BMI Semester-VIII

Overview: Basic concept of eco-friendly mining. Selection of eco-friendly equipment and exploitation operations, **Environmental Parameters:** Water quality – physical, chemical, biological, criteria and standards. Classification and chemistry of major air pollutants. Soil chemistry – nature and importance of soil, soil properties, soil amendments, **Waste Management:** Waste water management – sources characteristics, techniques of treatment. Acid mine drainage – occurrence, effects and treatment techniques. Solid waste management for mine spoils, **Mine Reclamation & Mine Closure:** Mine Reclamation strategies, Principles, planning, financial provisions, implementation, standards for closure criteria, systems approach for mine closure and development of closure plan, **Socio-economic Aspects of Mining.**

Essential Reading : 1. H. S. Peavy, D. R. Rowe and G. Tchobanoglous, *Environmental Engineering*, McGraw-Hill Publishing Co.; 7th Rev Ed edition, 2000.
2. C. J. Barrow, *Environmental Management: Principles and Practice* (Routledge Environmental Management Series) Routledge, 1st edition, 1999. **Supplementary Reading :**
1. I. P. G. Hutchison, and R. D.Ellison, *Mine Waste Management*, CRC Press, 1st edition,1992
2. G. Burke, B.R. Singh and L. Theodore, *Handbook of Environmental Management and Technology*, Wiley-Interscience, 2nd edition, 2000.
3. N.C Saxena, *Mining Environment Management Manual*, Scientific Publishers (India), 2004 4.
M. J. Hammer, *Water and Wastewater Technology*, Prentice Hall, 6th edition, 2007.

MINE PLANNING AND DESIGN LABORATORY

Course/Paper: 08 BMI -201
BMI Semester-VIII

LIST OF EXPERIMENTS:
1. Preparation of data base for mine evaluation
2. Create a geological data base and import all data files
3. Performing data compositing and statistical analysis
4. Create digital terrain model and surface contouring
5. Create section and digitization of individual sections
6. Create solid model using sections
7. Perform volume and area calculation of solid model, Union and intersection of different sections
8. Create block model; estimation of block models using inverse distance and polygonal method
9. Performing variogram analysis, fitting variogram, checking anisotropy
10. Intersection of block model and solid model; resource evaluation using ordinary kriging technique
11. Blast design using SURPAC software
12. Mine design using SURPAC software
13. Ultimate pit limit calculation
14. Determination of Grade tonnage curve and study the conditional biased in estimation

'MAJOR PROJECT

Course/Paper: 08 BMI -202
BMI Semester-VIII

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution.

The student should select any one of the topics offered from the department or select one on his own duly approved from the department. Candidate is required to submit the detailed synopsis of the work that he would complete in the part-II

Each student shall finally produce a comprehensive report covering back ground information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

SEMINAR

Course/Paper: 08 BMI -203
BMI Semester-VIII

OBJECTIVE

The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.
Students have to give a final presentation for 15 minutes on his topic. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews