



**ANNA UNIVERSITY  
CHENNAI - 600 025**

**UNIVERSITY DEPARTMENTS**

**REGULATIONS 2012**

**CURRICULA AND SYLLABI FOR  
I TO VIII SEMESTERS**

**B.E. MINING ENGINEERING  
(FULL TIME)**



**ANNA UNIVERSITY::CHENNAI 600 025****UNIVERSITY DEPARTMENT****R – 2012****B.E. MINING ENGINEERING****I TO VIII SEMESTERS CURRICULA AND SYLLABI****SEMESTER – I**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
HS8151	Technical English - I	3	1	0	4
MA8151	Mathematics – I	3	1	0	4
PH8151	Engineering Physics	3	0	0	3
CY8151	Engineering Chemistry	3	0	0	3
GE8151	Computing Techniques	3	0	0	3
GE8152	Engineering Graphics	2	0	3	4
<b>PRACTICAL</b>					
PH8161	Physics Laboratory	0	0	2	1
CY8161	Chemistry Laboratory	0	0	2	1
GE8161	Computer Practices Laboratory	0	0	3	2
GE8162	Engineering Practices Laboratory	0	0	3	2
	<b>TOTAL</b>	<b>17</b>	<b>2</b>	<b>13</b>	<b>27</b>

*\*Note:* The Common Course Committee for I Semester shall provide the syllabus for all the subjects of I Semester.

**SEMESTER – II**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
HS8251	Technical English II	3	1	0	4
MA8251	Mathematics II	3	1	0	4

PH8251	Materials Science	3	0	0	3
CY8202	Chemistry for Mining Engineering	3	0	0	3
GE8251	Engineering Mechanics	3	1	0	4
EE8251	Basic Electrical Engineering and Measurements	3	0	0	3
MI8201	Mine Development	3	0	0	3
<b>PRACTICAL</b>					
ME8261	Computer Aided Machine Drawing	0	0	3	2
ME8262	Manufacturing Technology Laboratory – I	0	0	3	2
	<b>TOTAL</b>	<b>21</b>	<b>3</b>	<b>6</b>	<b>28</b>

\*\*Note: The syllabus for the course – MINE DEVELOPMENT is provided herewith and the Common Course Committee for II Semester shall provide the syllabus for the remaining subjects

### SEMESTER – III

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
AG8301	Geology – I	3	0	0	3
CE 8353	Strength of Materials	3	0	0	3
EC8302	Basic Electronics Engineering	3	0	0	3
EE8305	Electrical Drives and Control	3	0	0	3
ME8303	Basic Mechanical Engineering for Mining	3	0	0	3
MI8301	Drilling and Blasting	3	0	0	3
<b>PRACTICAL</b>					
EC8361	Electronics Engineering Laboratory	0	0	3	2
EE8262	Electrical Engineering Laboratory	0	0	3	2
MI8311	Practical Training – I*	0	0	0	1
	<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>6</b>	<b>23</b>

\* The students would be undergoing **Training in Mines** during the Summer Vacation at the end of the **Second Semester** for a period of 15 to 30 days. The students have to submit a report on the Training which would be evaluated and the grades for the same would be awarded and reported in the ensuing **Third Semester**.

**SEMESTER – IV**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
AG8401	Geology – II	3	0	0	3
CE8352	Fluid Mechanics and Machinery	3	0	0	3
CE8405	Engineering Surveying	3	0	0	3
EE8408	Instrumentation Engineering	3	0	0	3
MI8401	Mine Environmental Engineering - I	3	0	0	3
MI8402	Mining Machinery- I	3	0	0	3
MI8403	Surface Mining	3	0	0	3
<b>PRACTICAL</b>					
AG8411	Geology Laboratory - I	0	0	2	1
CE8361	Fluid Mechanics and Machines Laboratory	0	0	3	2
ME8412	Basic Mechanical Engineering Laboratory for Mining	0	0	4	2
<b>TOTAL</b>		<b>21</b>	<b>0</b>	<b>9</b>	<b>26</b>

**SEMESTER – V**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
MA8501	Statistics and Numerical Methods	3	1	0	4
MI8501	Mine Environmental Engineering - II	3	0	0	3
MI8502	Mine Surveying	3	0	0	3
MI8503	Mineral Processing	3	0	0	3
MI8504	Mining Machinery - II	3	0	0	3
MI8505	Rock Mechanics and Ground Control - I	3	0	0	3
MI8506	Underground Mining Methods -Coal	3	0	0	3
<b>PRACTICAL</b>					
AG8511	Geology Lab II and Field work	0	0	2	1

EE8514	Instrumentation Engineering Laboratory	0	0	2	1
MI8511	Practical Training – II**	0	0	0	1
MI8512	Survey Laboratory - I	0	0	4	2
	<b>TOTAL</b>	<b>21</b>	<b>1</b>	<b>8</b>	<b>27</b>

\*\* The students would be undergoing **Training in Mines** during the Summer Vacation at the end of the **Fourth Semester** for a period of 15 to 30 days. The students have to submit a report on the Training which would be evaluated and the grades for the same would be awarded and reported in the ensuing **Fifth Semester**.

### SEMESTER – VI

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
ME8652	Industrial Management	3	0	0	3
MI8601	Computer Applications in Mining	3	0	0	3
MI8602	Rock Mechanics and Ground Control - II	3	0	0	3
MI8603	Underground Mining Methods - Metal	3	0	0	3
	Elective - I	3	0	0	3
<b>PRACTICAL</b>					
HS8561	Employability skills	0	0	2	1
MI8611	Mineral Processing Laboratory	0	0	2	1
MI8612	Mining Machinery Laboratory	0	0	2	1
MI8613	Rock Mechanics and Ground Control Laboratory - I	0	0	2	1
MI8614	Survey Lab - II	0	0	4	2
<b>TOTAL</b>		<b>15</b>	<b>0</b>	<b>12</b>	<b>21</b>

### SEMESTER – VII

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MI8701	Mine Economics and Investment	3	0	0	3

MI8702	Mine Environmental Engineering - III	3	0	0	3
MI8703	Mine Planning and Design	3	0	0	3
	Elective - II	3	0	0	3
<b>PRACTICAL</b>					
MI8711	Comprehension	0	0	2	1
MI8712	Computer Applications in Mining Laboratory	0	0	4	2
MI8713	Mine Environmental Engineering Laboratory	0	0	2	1
MI8715	Practical Training – III***	0	0	0	1
MI8716	Rock Mechanics and Ground Control Laboratory- II	0	0	2	1
MI8717	Survey Camp	0	0	0	1
MI8714	Mini Project	0	0	4	2
	<b>TOTAL</b>	<b>12</b>	<b>0</b>	<b>14</b>	<b>21</b>

\*\*\* The students would be undergoing **Training in Mines** during the Summer Vacation at the end of the **Sixth Semester** for a period of 15 to 30 days. The students have to submit a report on the Training which would be evaluated and the grades for the same would be awarded and reported in the ensuing **Seventh Semester**.

#### SEMESTER – VIII

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MI8801	Mine Legislation and Safety	3	0	0	3
	Elective – III	3	0	0	3
<b>PRACTICAL</b>					
MI8811	Project Work	0	0	12	6
<b>TOTAL CREDITS</b>		<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**TOTAL CREDITS: 185**

### ELECTIVES

Sl.No.	Code No.	Course Title	L	T	P	C
	MI8001	Advanced Coal Mining and Mechanization	3	0	0	3
	MI8002	Advanced Metal Mining and Mechanization	3	0	0	3
	MI8003	Advanced Surface Mining	3	0	0	3
	MI8004	Energy Conservation and Management	3	0	0	3
	MI8005	Longwall Mining	3	0	0	3
	MI8006	Material Handling	3	0	0	3
	MI8007	Material Management	3	0	0	3
	MI8008	Mine Safety Engineering	3	0	0	3
	MI8009	Mineral Exploration	3	0	0	3
	MI8010	Non-destructive Testing	3	0	0	3
	MI8011	Numerical Methods in Mining Engineering	3	0	0	3
	MI8012	Object Oriented Programming	3	0	0	3
	MI8013	Petroleum Engineering	3	0	0	3
	MI8014	Rock Excavation Engineering	3	0	0	3
	MI8015	Rock Reinforcement	3	0	0	3
	MI8016	Rock Slope Engineering	3	0	0	3
	MI8017	Small Scale and Marine Mining	3	0	0	3
	MI8018	Subsidence Engineering	3	0	0	3
	MI8019	Systems Engineering in Mining	3	0	0	3
	GE8071	Fundamental of Nano Sciences	3	0	0	3



	GE8751	Engineering Ethics and Human Values	3	0	0	3
	MG8652	Management Sciences	3	0	0	3
	MG8654	Total Quality Management	3	0	0	3
	ME8076	Entrepreneurship Development	3	0	0	3
	ME8078	New and Renewable Sources of Energy	3	0	0	3
	ME8752	Finite Element Analysis	3	0	0	3
	MF8078	Quality Control and Reliability Engineering	3	0	0	3



**OBJECTIVES:**

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology students.
- To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

**UNIT I**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) -

Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

#### **UNIT IV**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations & acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

#### **UNIT V**

Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

**TOTAL : 60 PERIODS**

#### **TEXT BOOK:**

1. Mindscapes: English for Technologies and Engineers, Orient Black Swan, 2012.
2. S.P. Dhanavel, English and Communication Skills for students of Science and Engineering Oriented Black Swan, Chennai 2011.

#### **REFERENCE BOOKS:**

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. Technical English: Writing, Reading and Speaking. New York: Longman, 2001.
2. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
3. Morgan, David and Nicholas Regan. Take-Off: Technical English for Engineering. Reading: Garnet Publishing Limited, 2008.

4. Thorn, Michael and Alan Badrick. An Introduction to Technical English. Harlow: Prentice Hall Europe, 1993.
5. Rizvi, M.Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill Publishing Company, 2007.

### **EXTENSIVE READERS**

1. Murthy, Sudha. Wise & Otherwise. New Delhi: Penguin Books India, 2006.
2. Gates, Bill and Collins Hemingway. Business @ the Speed of Thought: Succeeding in the Digital Economy. New York: Warner Business Books, 2000.

### **WEBSITE RESOURCES:**

1. [www.uefap.com](http://www.uefap.com)
2. [www.eslcafe.com](http://www.eslcafe.com)
3. [www.listen-to-english.com](http://www.listen-to-english.com)
4. [www.owl.english.purdue.edu](http://www.owl.english.purdue.edu)
5. [www.chompchomp.com](http://www.chompchomp.com)

**MA8151**

**MATHEMATICS – I**  
**(Common to all branches of B.E. /**  
**B.Tech. Programmes in I Semester)**

**L T P C**  
**3104**

### **OBJECTIVES:**

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### **UNIT I      MATRICES**

**9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of

eigenvalues and eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

## **UNIT II INFINITE SERIES**

**9+3**

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D’Alembert’s ratio test) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

## **UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3**

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler’s theorem – Total derivative – Differentiation of implicit functions – Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

## **UNIT IV IMPROPER INTEGRALS**

**9+3**

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions.

## **UNIT V MULTIPLE INTEGRALS**

**9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

**TOTAL : 60 PERIODS**

### **TEXT BOOKS:**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

### **REFERENCES:**

1. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.

2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

**PH8151**

**ENGINEERING PHYSICS**  
(Common to ALL Branches of B.E./B.Tech. Programmes)

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

**UNIT I      PROPERTIES OF MATTER**

**9**

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

**UNIT II      ACOUSTICS AND ULTRASONICS**

**9**

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

**UNIT III      THERMAL PHYSICS**

**9**

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity - conduction in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radial flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

**UNIT IV APPLIED OPTICS****9**

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO<sub>2</sub>, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

**UNIT V SOLID STATE PHYSICS****9**

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Gaur R.K., and Gupta, S.L., Engineering Physics, Dhanpat Raj Publications, 2003.
2. Palanisamy, P.K., Engineering Physics, Scitech Publications (P) Ltd, 2006.
3. Arumugam, M., Engineering Physics, Anuradha Publications, 2000.

**REFERENCES:**

1. Sankar, B.N., Pillai.S.O., Engineering Physics, New Age International (P) Ltd., 2007.
2. Rajendran.V Engineering Physics, Tata McGraw-Hill, 2009.

**CY8151****ENGINEERING CHEMISTRY****L T P C****(Common to all branches of Engineering and Technology)****3 0 0 3****UNIT I CHEMICAL THERMODYNAMICS****9**

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.



## **UNIT II POLYMER CHEMISTRY**

**9**

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

## **UNIT III KINETICS AND CATALYSIS**

**9**

Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

## **UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY**

**9**

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

## **UNIT V NANOCHEMISTRY**

**9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

**TOTAL: 45 PERIODS**

## **TEXT BOOKS**

1. P. Kannan and A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.
2. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India, 2011

## REFERENCE BOOKS:

1. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, "Fundamental of Photochemistry" New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006

**GE8151**

**COMPUTING TECHNIQUES**

**L T P C**

**3 0 0 3**

### **UNIT I INTRODUCTION**

**8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

### **UNIT II C PROGRAMMING BASICS**

**10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

### **UNIT III ARRAYS AND STRINGS**

**9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String-String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

### **UNIT IV FUNCTIONS AND POINTERS**

**9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

### **UNIT V STRUCTURES AND UNIONS**

**9**

Introduction – need for structure data type – structure definition – Structure declaration –

Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

### **TEXTBOOKS**

1. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.

### **REFERENCES**

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Byron S Gottfried, “ Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

**GE8152**

**ENGINEERING GRAPHICS**

**L T P C**  
**2 0 3 4**

### **OBJECTIVES**

To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

### **Concepts and conventions (Not for Examination)**

**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

### **UNIT I PLANE CURVES AND FREE HAND SKETCHING**

**14**

Basic Geometrical constructions, Curves used in engineering practices

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14**

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 14**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids- Prisms, pyramids and cylinders by visual ray method and vanishing point method.

**COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS**

**TEXT BOOKS**

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010

## REFERENCES

1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) Subhas Stores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,,” Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production”, Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited ,2008.
5. K. V.Natrajan, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi,2008.

### Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection

### Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**PH8161**

**PHYSICS LABORATORY**  
**(common to all branches of B.E./B.Tech. Programmes)**

**L T P C**

**0 0 2 1**

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
2. Non – uniform bending – Determination of young’s modulus

3. Lee's disc – Determination of thermal conductivity of a bad conductor
4. Potentiometer – Determination of thermo e.m.f. of thermocouple
5. Air wedge – Determination of thickness of a thin sheet of paper
6. i. Optical fibre – Determination of Numerical Aperture and acceptance angle
- ii. Compact disc – Determination of width of the groove using laser
7. Acoustic grating – Determination of velocity of ultrasonic waves in liquids
8. Post office box – Determination of Band gap of a semiconductor
9. Spectrometer – Determination of wavelength using grating
10. Viscosity of liquids – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

**TOTAL : 30 PERIODS**

**CY8161**

**CHEMISTRY LABORATORY**

**L T P C**

**(Common to all branches of Engineering and Technology)**

**0 0 2 1**

1. Estimation of HCl using Na<sub>2</sub>CO<sub>3</sub> as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

**TOTAL: 30 PERIODS**

## REFERENCE BOOKS

1. A text of quantitative inorganic analysis, A. L. Vogel , ELBS London. 1995.
2. Experiments in physical chemistry, D.P. Shoemaker and C.W. Gardad, McGraw Hill, London, 2001.
3. American Public Health Association.

**GE8161**

**COMPUTER PRACTICES LABORATORY**

**L T P C  
0032**

### LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**GE8162**

**ENGINEERING PRACTICES LABORATORY  
(COMMON TO ALL BRANCHES OF B.E./B.TECH. PROGRAMMES)**

### OBJECTIVE

To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

### GROUP – A (CIVIL & ELECTRICAL)

#### 1. CIVIL ENGINEERING PRACTICE

**12**

##### Plumbing

Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

Laying pipe connection to the suction side of a pump – inlet.

Laying pipe connection to the delivery side of a pump – out let.

Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

### **Wood Work**

Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

### **Study**

Study of joints in door panels, wooden furniture

Study of common industrial trusses using models.

## **2. ELECTRICAL ENGINEERING PRACTICE**

**9**

Basic household wiring using switches, fuse, indicator – lamp etc.,

Preparation of wiring diagrams

Stair case light wiring

Tube – light wiring

Study of iron-box, fan with regulator, emergency lamp

## **GROUP – B**

## **(MECHANICAL AND ELECTRONICS)**

**15**

## **3. MECHANICAL ENGINEERING PRACTICE**

### **Welding**

Arc welding of butt joints, lap joints, tee joints

Gas welding Practice.

Basic Machining

Simple turning, drilling and tapping operations.

Machine assembly Practice.

Study and assembling the following:

Centrifugal pump, mixies and air conditioners.

Demonstration on

(a) Smithy operations like the production of hexagonal bolt.

(b) Foundry operation like mould preparation for grooved pulley.



#### 4. ELECTRONIC ENGINEERING PRACTICE

9

Soldering simple electronic circuits and checking continuity.

Assembling electronic components on a small PCB and testing.

Study of Telephone, FM radio, low-voltage power supplies.

**TOTAL: 45 PERIODS**

**HS8251**

#### **TECHNICAL ENGLISH II (For all branches of B.E / B.Tech programmes)**

**L T P C  
3 1 0 4**

- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

#### **UNIT I**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

#### **UNIT II**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories

/ novels from links), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

### **UNIT III**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); Reading - Speed reading – reading passages with the time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

### **UNIT IV**

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

### **UNIT V**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and

vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

### **TEXT BOOK:**

1. Mindscapes: English for Technologies and Engineers, Orient Black Swan, 2012.
2. S.P. Dhanavel, English and Communication Skills for students of Science and Engineering Oriented Black Swan, Chennai 2011.

### **REFERENCE BOOKS:**

1. Laws, Anne. Presentations. Hyderabad: Orient BlackSwan, 2000.
2. Lewis, Hedwig. Body Language: A Guide for Professionals. New Delhi: Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell. Telephoning in English. Cambridge: Cambridge University Press, 1987.
4. Rutherford, Andrea J. Basic Communication Skills for Technology. New Delhi: Pearson Education, 2001.
5. Ur, Penny. Teaching Listening Comprehension. Cambridge: Cambridge University Press, 1984.

### **EXTENSIVE READERS**

1. Abdul Kalam, A P J. Ignited Minds: Unleashing the Power within India. New Delhi: Penguin Books India, 2002.
2. Parameswaran, Uma. C.V.Raman: A Biography. New Delhi: Penguin Books India, 2011.

### **WEB RESOURCES**

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishgrammar.org](http://www.englishgrammar.org)
3. [www.englishclub.com](http://www.englishclub.com)
4. [www.mindtools.com](http://www.mindtools.com)
5. [www.esl.about.com](http://www.esl.about.com)

**OBJECTIVES:**

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I DIFFERENTIAL EQUATIONS****9+3**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

**UNIT II VECTOR CALCULUS****9+3**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTION****9+3**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation.

**UNIT IV COMPLEX INTEGRATION****9+3**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

**UNIT V LAPLACE TRANSFORMS****9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function

and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem — Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

**TOTAL : 60 PERIODS**

**TEXT BOOKS:**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana, B.V. “Higher Engineering Mathematics”, Tata McGraw Hill, New Delhi, 2010.

**REFERENCES:**

1. Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, New Delhi, 2007.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
4. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, New Delhi, 2007.

**PH8251**

**MATERIALS SCIENCE**

**L T P C**

**(Common to Manufacturing, Industrial, Mining, Mechanical,  
Aeronautical, Automobile and Production Engineering)**

**3 0 0 3**

**OBJECTIVE:**

To introduce the essential principles of materials science for mechanical and related engineering applications.

**UNIT I MECHANICAL PROPERTIES**

**9**

Introduction to mechanical properties - tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods

of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

## **UNIT II PHASE DIAGRAMS 9**

Solid solutions - Hume Rothery's rules - free energy of solid solution - intermediate phases - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the level rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions - microstructural change during cooling.

## **UNIT III FERROUS ALLOYS AND HEAT TREATMENT 9**

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - pearlitic transformations - T-T-T-diagram for eutectoid steel - bainitic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

## **UNIT IV ELECTRONIC MATERIALS 9**

Classification of solids - energy bands - concept of Fermi level - conductor, semiconductor, insulator - Semiconductors: intrinsic, extrinsic - carrier concentration expression (qualitative) - compound semiconductors (qualitative) - dielectric materials - polarization mechanisms - dielectric breakdown - magnetic materials - ferromagnetic materials & hysteresis - ferrites - superconducting materials, properties, types and applications.

## **UNIT V NEW MATERIALS AND APPLICATIONS 9**

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics - Fibre reinforced Metal - Metallic glasses - Shape memory alloys - Copper base alloys - Nickel - Titanium alloys - Relaxor- Ferroelectric materials - Electro and magneto rheological fluids - Sensors and Actuators - polymer semiconductors - photoconducting polymers - liquid crystals - Bio-sensors - Scintillation detectors (Position sensitive) - Bio materials - hydroxyapatite - PMMA - Silicone.

**TOTAL : 45 PERIODS**

### **TEXT BOOK:**

1. Raghavan, V., Materials Science and Engineering, Prentice Hall of India, 2007.

2. Palanisamy, P.K., Applied Materials Science, Scitech, 2003.
3. Raghavan, V., Physical Metallurgy, Prentice Hall of India, 2002.

**REFERENCE BOOKS:**

1. Calister, W.D., Materials Science and Engineering an Introduction, John Wiley, 2003.
2. Rajendarn V and Marikani A, Materials Science, Tata McGraw Hill, 2006

**CY8202**

**CHEMISTRY FOR MINING ENGINEERING**

**L T P C**  
**3 0 0 3**

**AIM**

- To impart knowledge on the Applied Chemistry topics important in Mining Engineering.

**OBJECTIVES:**

To make the students conversant with

- Treatment of water for domestic and industrial purpose
- Applications of different kinds of Polymers, Lubricants and adhesives.
- Types and mechanism of corrosion and control measures
- Application of different types of abrasives and chemical nature of building materials and composites
- Chemistry of different types of Fuels and Explosives

**UNIT I WATER TREATMENT**

**8**

Different types of impurities in water-disadvantages of hard water in industries – conditioning methods – external treatment methods –zeolite and ion exchange methods – internal treatment (colloidal, phosphate, calgon, carbonate methods) – desalination (reverse osmosis and electro-dialysis) – requisites of drinking water – treatment of domestic water (screening, sedimentation, coagulation, filtration, disinfection – by chlorination, UV treatment, ozonization).

**UNIT II POLYMERS, LUBRICANTS AND ADHESIVES**

**10**

Thermosetting and thermoplastics resins – properties and applications of polythene, polypropylene, TEFLON, polystyrene, polyvinyl chloride, PMMA, polyamides, polyesters, bakelite, vulcanization of rubber – rubber blended plastics – laminated plastics – laminated glass – thermocole. Lubricants and lubrication- functions- classification with examples-properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point)- greases (calcium based, sodium based, lithium based only)- solid lubricants-graphite and molybdenum sulphide. Adhesives – adhesive action – development of adhesive

strength – physical and chemical factors influencing adhesive action – bonding process of adhesives –phenol formaldehyde resins, polyurethane, epoxy resins, urea formaldehyde

### **UNIT III CORROSION AND CORROSION INHIBITION 8**

Corrosion – causes of corrosion – principles of chemical corrosion – Pilling – Bedworth rule – principles of electrochemical corrosion – difference between chemical and electrochemical corrosion – factors influencing corrosion – types of corrosion – galvanic corrosion – differential aeration corrosion – stress corrosion – soil corrosion – pitting corrosion, water line corrosion – corrosion control – cathodic protection – sacrificial anode – selection of materials and proper designing – corrosion inhibitors, protective coatings.– Paints, varnishes and lacquers- Electroplating- hot dip process.

### **UNIT IV ABRASIVES AND CHEMISTRY OF BUILDING MATERIALS 9**

Cement – chemical composition – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements – high alumina cement, sorel cement, white Portland cement, water proofing, and quick setting cement – lime – classification – manufacture, setting and hardening – refractories – requisites –classification – common refractory bricks – preparation, properties and uses of silica bricks, high alumina bricks, magnesite bricks, carbon bricks, zirconia bricks and carborundum – composites – definition of composites – characteristics – constituents of composites – types – fibre reinforced plastic (FRP) – metal matrix composites (MMC) – ceramic matrix composites (CMC) – properties and applications. Mohr’s scale of hardness- natural abrasives (diamond, corundum, emery, garnets and quartz)- artificial abrasives (silicon carbide, boron carbide).

### **UNIT V FUELS AND EXPLOSIVES**

**10**

Classification of fuels (solid, liquid and gases) comparison- coal varieties- analysis of coal, proximate analysis and ultimate analysis - significance- coke manufacture (Beehive coke oven and Otto-Hoffman by product coke oven method)- characteristics of metallurgical coke- Petrol- knocking-Octane Number- improvement of antiknock characteristics- diesel engine fuel- Cetane Number- gaseous fuels- composition and uses of producer gas, water gas and natural gas- combustion –gross and net calorific values- theoretical calculation of calorific value (Dulong’s formula)- calculation of minimum requirement of air (simple calculations)- explosive range, spontaneous ignition temperature – flue gas analysis – Orsat apparatus. Chemistry of different types of industrial explosives like – gun powder, dynamite, Nitroglycerin Based explosives, Ammonium Nitrate Based explosives, Ammonium Nitrate fuel oil, PETN, TNT, Liquid oxygen, slurry explosives and emulsion explosives.

**TOTAL: 45 PERIODS**



### **TEXT BOOKS:**

1. Jain P.C. and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2002.
2. Dara.S.S., A Textbook of Engineering Chemistry, S.Chand & Company Ltd., New Delhi, 2003.

### **REFERENCE BOOKS**

1. Nanjundan, S. and Sreekultan Unnithan, C., Applied Chemistry, Sree Lakshmi Publications, Chennai, 2001.
2. Sadasivam, V., Modern Engineering Chemistry – A Simplified Approach, Vol.I, Kamakya Publications, Coimbatore, 2003.

**GE8251**

**ENGINEERING MECHANICS**

**L T P C**

**3 1 0 4**

### **OBJECTIVE**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

### **UNIT I BASICS AND STATICS OF PARTICLES 12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

### **UNIT II EQUILIBRIUM OF RIGID BODIES**

**12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

### **UNIT III PROPERTIES OF SURFACES AND SOLIDS**

**12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular,

triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

#### **UNIT IV DYNAMICS OF PARTICLES**

**12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion -Newton’s laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

#### **UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**

**12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL: 60 PERIODS**

#### **TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R. “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004)
2. Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)

#### **REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education (2010).
2. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4th Edition, Pearson Education (2006)
3. J.L.Meriam and L.G.Kraige, “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2,Third Edition, John Wiley & Sons,(1993)
4. Rajasekaran, S and Sankarasubramanian, G., “Engineering Mechanics Statics and Dynamics”,3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
5. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers, (1998).
6. Kumar, K.L., “Engineering Mechanics”, 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008)

**AIM**

To provide knowledge in the basic concepts of Electric Circuits, Electrical machines and Measurement techniques.

**OBJECTIVE:**

To impart knowledge on

- I. Electric circuit laws
- II. Principle of Electrical Machines
- III. Various measuring instruments

**UNIT I ELECTRICAL CIRCUITS****9**

Ohms Law – Kirchoff's Law-Steady state solution of DC circuits – introduction to AC circuits – waveforms and RMS value – Power and power factor- Three phase balanced and unbalanced circuits-Three phase Power measurement.

**UNIT II ELECTRICAL MACHINES****9**

Construction and Principle of operation DC machines- Characteristics of DC machines  
Construction and Principle of operation of single phase transformers, synchronous machines, three-phase and single-phase induction motors

**UNIT III MEASUREMENT AND INSTRUMENTATION****9**

Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type wattmeters – Energy meter – Megger – Instrument transformers (CT & PT) – Wheatstone's bridge for measurement of unknown resistance, Maxwell's bridge for unknown inductance and Schering Bridge for unknown capacitance

**UNIT IV TRANSDUCERS****9**

Classification of transducers, strain, RTD, thermocouples, Piezo-electric transducer, LVDT, Turbine and electromagnetic flow meters, level transducers ultrasonic and fiber optic transducers, type of sensors, elastic sensors, viscosity, moisture and pH sensors, Digital transducers, vibrating wire instruments like load cells, stress meter, etc.

## **UNIT V SIGNAL CONDITIONING AND DISPLAY**

**9**

Instrumentation amplifiers- Filters- A/D and D/A converters - Multiplexing and data acquisition  
- LED, LCD and CRT displays.

**TOTAL: 45 PERIODS**

### **TEXT BOOKS**

1. Del Toro 'Electrical Engineering Fundamentals' Pearson Education, New Delhi, 2007.
2. V.K Mehta and Rohit Mehta 'Principle of Electrical Engineering' S Chand & Company, 2008
3. Alan S. Moris, Principles of Measurements and Instruments, Printice-Hall of India Pvt. Ltd., New Delhi, 1999.
4. Smarjit Ghosh 'Fundamentals of Electrical and Electronics Engineering, Second Edition 2007

### **REFERENCES**

1. Rajendra Prasad 'Fundamentals of Electrical engineering' Prentice Hall of India, 2006.
2. Thereja .B.L 'Fundamentals of Electrical Engineering and Electronics' S chand & Co Ltd, 2008.
3. Sanjeev Sharma 'basics of Electrical Engineering' S.K International Publishers, New Delhi 2007.
4. John Bird, Electrical Circuits theory and Technology, Elsevier, First India Edition, 2006.
5. Doebeling, E.O., Measurements Systems – Application and Design', McGrawHill Publishing Co, 1990.

**MI 8201**

**MINE DEVELOPMENT**

**L T P C**

**3 0 0 3**

### **OBJECTIVES:**

1. To introduce the field of mining and provide basic input about mining unit operations.
2. To know the history of mining and describe the correlation between the development of mining and cultural progress.
3. To study concept of exploration & development drilling, blasting and the technology employed.
4. To learn the various modes of access and study the methods of designing the access.

**UNIT I INTRODUCTION TO MINING 8**

History of mining, contribution of mining to civilisation and national economy Indian mineral resources and world status, role of mining engineers in industry. Introduction to opencast and underground coal & metalliferous mining – selection criteria, comparison. Modes of entry into deposits for underground mining – shafts, inclines, adits, etc.

**UNIT II INTRODUCTION TO DRILLING 10**

Principles of drilling, methods, selection, applications and limitations, drill bits, flushing methods, fields of application, exploration and production drilling, drilling in underground workings, variables affecting the performance of drilling, novel methods of drilling.

**UNIT III SHAFT SINKING 10**

Selection of site and size, sinking methods, support system, ventilation, lighting and drainage arrangements during sinking, material handling and safety in sinking shafts. Introduction to piling, caisson and freezing methods - cementation method - widening and deepening of shafts. Modern techniques of shaft sinking – shaft boring, design of shaft insets, pit bottom excavation and shaft raising.

**UNIT IV INTRODUCTION TO EXPLOSIVES AND BLASTING 10**

Types of explosives, fuses, detonators and other accessories, alternatives to explosives, cause of accidents and safety precautions, drilling and blasting pattern for underground excavations, merits, demerits and limitations of blasting. Storage and transport of explosives.

**UNIT V DRIFTING AND TUNNELING 7**

Drivage of drifts, organisation and cycle of operations, supporting of development workings, modern methods of drifting, tunnelling, road heading and tunnel boring.

**TOTAL: 45 PERIODS**

**REFERENCE BOOKS:**

1. Hartman, H.L., Introduction to Mining Engineering, John Wiley and Sons, Second Edition, 1999.
2. Deshmukh, D.J., Elements of Mining Technology, Vol.I, Vidyaseva Prakashan, Nagpur, 1994.
3. Chugh, C.P., Drilling Technology Hand Book, Oxford & IBH Publications, 1994.
4. Chugh, C.P. Diamond Drilling, Oxford & IBH Publishers, 1999.
5. Karnam, U.M.R., Principles of Rock Drilling, 1999.

6. Bhandari S., Engineering rock blasting operations, A. A. Balkema, 1997.
7. Cummings, A.B. and Given, I.A., SME Mining Engineers' Handbook, Vol.I and II, Society of Mining Engineers, New York, 1993.
8. Universal Mining School - Lecture notes, Cardiff, U.K

**ME8261**

**COMPUTER AIDED MACHINE DRAWING**

**L T P C**

**0 0 3 2**

**OBJECTIVE**

- To make the students understand and interpret drawings of machine components so as to prepare assembly drawings both manually and using standard CAD packages.
- To familiarize the students with Indian Standards on drawing practices and standard components.

**UNIT I DRAWING STANDARDS**

**3**

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

**UNIT II FITS AND TOLERANCES**

**3**

Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.

**UNIT III INTRODUCTION TO DRAFTING PACKAGE**

**6**

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Matching, Detailing, Detailed drawing, Basic principles of geometric dimensioning & tolerancing.

**UNIT IV ASSEMBLY DRAWING (Preparation of 2D assembled views for the given part details)**

**33**

Preparation of assembled views, both manually and using software package, given part details for components such as Shaft couplings – Plummer block – Screw jack – Lathe Tailstock – Universal joint – Machine Vice – Stuffing box – Crosshead – Safety Valves – Non-return valves – Connecting rod – Piston and crank shaft – Multi plate clutch – Preparation of Bill of materials and tolerance data sheet.

TOTAL: 20% of classes for theory classes and 80% of classes for practice = 45 PERIODS

Note: 50% of assembly drawings must be done manually and remaining 50% of assembly drawings must be done by using any 2D drafting package)

### **TEXT BOOKS**

1. Gopalakrishna K.R., "Machine Drawing", 17th Edition, Subhas Stores Books Corner, Bangalore, 2003.

### **REFERENCES**

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 45th Edition, Charator Publishers, 2010
2. Goutam Pohit and Goutam Ghosh, "Machine Drawing with AutoCAD", 1st Edition, Pearson Education, 2004
3. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
4. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata Mc GrawHill, 2006
5. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

**ME8262**

**MANUFACTURING TECHNOLOGY LABORATORY – I**

**L T P C**

**0 0 3 2**

### **OBJECTIVES:**

To Study and practice the various operations that can be performed in lathe, shaping, drilling, milling etc. and to equip with the practical knowledge required in the core industries.

### **LIST OF EXPERIMENTS:**

Machining , Measurement and Machining time estimations of :

Taper Turning

External Thread cutting

Internal Thread Cutting

Eccentric Turning

Knurling

Square Head Shaping

Hexagonal Head Shaping

**TOTAL: 45 PERIODS**





**TEXT BOOKS:**

1. Parbin Singh. Geology for Engineers, IBH Publications, N. Delhi. 1991.
2. Arthur Hagemess, Principles of Physical Geology, Thomas Nelson and Sons, USA, 1964.
3. Ford, W.E. Dana's Textbook of Mineralogy (4th edition), Wiley Eastern Ltd., N. Delhi, 1989.
4. Winter, J.D. An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, N. Delhi, 2001.
5. Billings, M.P. Structural Geology, Prentice Hall Inc., N. Jersey, USA, 1972.
6. Krishnan M.S. Geology of India and Burma, 3rd Edition, IBH Publishers, N. Delhi, 1984.

**REFERENCE BOOKS:**

1. Blyth F.G.H. and de Freitas M.H. Geology for Engineers, 7th edition, Elsevier Publications, 2006.
2. Bell F.G. Engineering Geology, Elsevier Publications, 2007.

**CE8353****STRENGTH OF MATERIALS****L T P C**

**(Common for Mechanical, Manufacturing, Industrial, Mining,  
Printing, Material Science and Engineering and Agriculture  
and Irrigation Engineering)**

**3 0 0 3****OBJECTIVE:**

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS****9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM****9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.





**AIM**

To provide knowledge in the area of electrical drives and their control techniques

**OBJECTIVES:**

To impart knowledge on

- I. Basics of electric drives
- II. Different speed control methods
- III. Various motor starters and controllers
- IV. Applications

**UNIT I INTRODUCTION 9**

Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors. Relay – control transformers.

**UNIT II SPEED CONTROL OF DC MACHINES 9**

DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits chopper circuits.

**UNIT III SPEED CONTROL OF AC MACHINES 9**

Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

**UNIT IV MOTOR STARTERS AND CONTROLLERS 9**

DC motor starters using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays -DOL -starter

**UNIT V HEATING AND POWER RATING OF DRIVE MOTORS 9**

Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. N.K De and P.K Sen 'Electric Drives' Prentice Hall of India Private Ltd, 2002.
2. Vedam Subramaniam 'Electric Drives' Tata McGraw Hill , New Delhi,2007
3. G.K.Dubey. 'Fundamentals of Electrical Drives' Narosa, Second Edition.

**REFERENCES:**

1. S.K Bhattacharya, Brinjinder Singh 'Control of Electrical Machines' New Age International Publishers,2002.
2. John Bird 'Electrical Circuit theory and technology' Elsevier, First Indian Edition, 2006.

**ME8303****BASIC MECHANICAL ENGINEERING FOR MINING****L T P C  
3 0 0 3****AIM:**

To equip the mining engineering students with the basic principles of operation of Mining Machinery.

**OBJECTIVES**

- To gain an understanding of the basic concepts of various aspects of Mechanical Engineering, fields of application, their merits, demerits, and limitations and applications to Mining Engineering.

**UNIT I BASIC CONCEPTS OF THERMODYNAMICS AND HEAT TRANSFER 10**

Definitions – continuum concept – properties – point and path functions – systems – processes – thermodynamic equilibrium - laws of thermodynamics – Steady Flow Energy Equation (SFEE) - first law applied to open and closed systems – steady and unsteady flow systems - Second law – heat engines and heat pumps – efficiency and Coefficient of Performance (COP).

Heat transfer – conduction – general conduction equation in Cartesian coordinates – conduction in composite walls. Convection – free and forced convection – simple empirical correlations. Radiation – laws – black body and grey body radiation.

**UNIT II IC ENGINES AND AIR CONDITIONING 8**

I C engines – classification - construction and working - two and four stroke engines – S I and C.I. engines – powdered coal as an alternative to diesel fuel.

Air conditioning – air cycles, vapour compression cycle – vapour absorption cycle – psychrometric processes. Air cooling – methods and simple cooling load calculations. systems applicable to mining environment.

### **UNIT III POWER TRANSMISSION 9**

Friction – surface contacts – sliding and rolling friction – friction drives – friction in screw threads, bearings, lubrication and introduction to mechanical and hydraulic clutches. Rope, belt and chain drives - introduction and simple calculations. braking – types and applications.

Gears – nomenclature, laws of gearing, types of gears including rack and pinion, interference, gear trains, calculation of gear ratios, couplings - types, features and applications.

Basic concepts in hydraulic & pneumatic power and devices and their utilisation – simple calculations.

### **UNIT IV KINEMATICS OF MACHINES 9**

Mechanisms – basics – kinematic concepts and definitions – degree of freedom, mechanical advantage – transmission angle – description of common mechanisms – quick return mechanisms, straight line generators, dwell mechanisms, ratchets and escapements – universal joints.

Cams and followers – terminology and definitions, displacement diagrams – uniform velocity, parabolic and simple harmonic motions.

### **UNIT V ROTODYNAMIC AND VIBRATORY MACHINES 9**

Fans and compressors – types, construction, working principle, characteristics and applications. Single stage and multistage air compressors – intercooling. Simple calculations for output and efficiency.

Vibration – Importance of free and forced vibration. Vibrators and shakers – construction, working principle, applications and limitations. HMT Data book to be permitted

**TOTAL: 45 PERIODS**

#### **TEXT BOOKS:**

1. Rajput, R.K. Thermal Engineering, 6th Edition, Laxmi Publications, 2007
2. Ballaney, P.L. Thermal Engineering, Khanna Publishers, 24th Edition, 2003
3. Shigley J.E., Pennock G.R. and Uicker J.J. Theory of Machines and Mechanisms, Oxford University Press, 2003.

## REFERENCE BOOKS:

1. Domkundwar, Kothandaraman, and Domkundwar. A Course in Thermal Engineering, Dhanpat Raj & Sons, Fifth edition, 2002.
2. Yunus A. Cengel. Heat Transfer - A Practical Approach – Tata Mc Graw Hill 2004.
3. Nag, P.K. Engineering Thermodynamics, 3rd Edition, Tata Mc Graw Hill, 2005
4. Thomas Bevan. Theory of Mechanics, CBS Publishers and Publishers and Distributers, 1984.
5. Ghosh, A. and Mallick A.K. Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd., New Delhi, 1988

**MI 8301**

**DRILLING AND BLASTING**

**L T P C**  
**3 0 0 3**

### **UNIT I EXPLORATORY DRILLING**

**9**

Drilling for exploration and other purposes; various types of drilling equipment – their merits, demerits and limitations; core recovery –single and double tube core barrels, wire line drilling; directional drilling, fishing tools; borehole surveying; borehole logging; novel and special drilling techniques. Drilling for oil and ground water.

### **UNIT II PRODUCTION DRILLING**

**9**

Production drilling; Various methods of drilling - percussive, rotary, rotary percussive, Factors affecting drilling; mechanics of drilling; drillability and drilling index; micro-bit drilling; selection of drilling equipment; different types of bit, bit wear; drill hole economics; case studies

### **UNIT III EXPLOSIVES, ACCESSORIES AND TOOLS**

**8**

Explosives and Blasting Agents- ANFO, slurry, emulsion, LOX, permitted explosives, bulk explosives; Selection of explosives; Blasting accessories, Initiation systems, Testing of explosives; Storage, transportation and handling of explosives; Destruction of explosives and accessories. Theories of rock breakage; mechanics of rock fragmentation by explosive action, Instrumentation in blasting –V.O.D probe, vibration monitoring, high speed video camera, etc.

### **UNIT IV BLASTING IN UNDERGROUND MINES**

**8**

Design of blast for coal and metal underground mines – gallery, Solid blasting techniques, periphery blasting, drilling pattern for tunneling and shaft sinking, controlled blasting techniques, dangers associated with underground blasting and preventive measures; misfires, blown out shots, incomplete detonation – their causes and remedial measures.

**UNIT V      BLASTING IN SURFACE MINES AND ALLIED ENGG. FIELDS****11**

Methods of blasting in surface mines, Blast design, Primary and secondary blasting, Rock fragmentation studies, Dangers associated with blasting in opencast mines and preventive measures, Environmental impacts due to blasting, Controlled blasting techniques, Blasting in opencast coal mines of developed galleries, Blasting economics, Computer aided design of blasts.

Blasting for road constructions, trench cutting, demolition of buildings etc; Blasting for Dimensional stones; Underwater blasting. Alternatives to blasting.

Note: Relevant portions of Coal and Metalliferrous Mines Regulations, DGMS Circulars shall be covered wherever required.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Hustrulid, W. A. Blasting Principles of Open Pit Mining, Vol. 1- General Design Concept, A.A. Balkema, Rotterdam, 1999.
2. Jimeno, C.L., Jimeno, E.L, Carcedo, E.J. Drilling and Blasting of Rocks, A.A.Balkema, Rotterdam, 1995.
3. Clark, G.B., Principles of Rock fragmentation, Wiley Interscience Publication, 1987.
4. Konya, C.J. and Walter, E.J. Surface Blast Design, New Jersey, 1990.
5. Bhandari, Sushil, Engineering Rock Blasting Operations, A.A.Balkema, Rotterdam, 1997.
6. Per-Anders Persson, Roger Holmberg, and Jaimin Lee. Rock Blasting and Explosives Engineering, CRC Press, 1994.

**REFERENCES:**

1. Kennedy, B.A., Surface Mining – 2nd Edition, SME, New York, 1990.
2. Pijush Pal Roy., Rock blasting: effects and operations, A.A. Balkema, Rotterdam, 2005.
3. Rao Karanam, U.M and Mishra. B, Principles of Rock Drilling, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1998.
4. Janusz Reś, Krzysztof Wladzielczyk and Ajoy K. Ghose., Environment-friendly techniques of rock breaking, CRC Press, 2003.
5. Muhamed Sućeska., Test Methods for Explosives, Springer, 1995.



**EC 8361**

**ELECTRONICS ENGINEERING LABORATORY**

**L T P C**

**0 0 3 2**

1. VI Characteristics of PN Junction and Zener Diodes.
2. Characteristics of CE configuration of Transistor.
3. Characteristics of UniJunction Transistor.
4. Characteristics of FET.
5. Operational Amplifier Applications – Adder, Multiplier.
6. RC Oscillator
7. LC Oscillators
8. IC 555 Astable and Monostable multivibrators
9. Half and Full adders
10. RS , T and D FFs
11. BCD counter using IC 7490

**TOTAL: 45 PERIODS**

**EE 8262**

**ELECTRICAL ENGINEERING LABORATORY**

**L T P C**

**0 0 3 2**

1. Speed Control of DC Shunt Motor
2. Load Test on DC Shunt Motor
3. Study of starters
4. Swinburne's Test
5. Load Test on DC Series Motor
6. Load Test on three Phase Alternator
7. Load Test on three Phase Induction Motor
8. Wheatstone's Bridge
9. Load Test on single phase Induction Motor.
10. Load test on Single Phase Transformer.

**TOTAL; 45 PERIODS**

**AIM:**

To impart practical experience to the student for gaining deeper understanding of the various activities and principles of mining.

Gaining practical experience is an important aspect of the mining engineering programme having many characteristic features of its own.

The students have to undergo training in mines during the summer vacation at the end of the II Semester for a period of 10 to 15 Days and obtain a valid certificate from the competent authority of the organisation provide training. The students have to submit a report on the training which would be evaluated during the ensuing VII Semester. This carries a total of one credit during the III Semester. Evaluation would be done by a faculty or a group of faculties on different marking heads such as training, viva voce report etc., or other approved evaluation systems.

Normally a student is not permitted to withdraw from the practical training. In case of any unforeseen circumstances / valid reasons if he could not undergo the training as scheduled, on the recommendation of the Head of the Department and approval by the competent authority the student may be permitted to undergo Practical Training-I before proceeding to V Semester. The decision of the competent authority is final.

**AIM:**

To study about the origin, distribution and exploration of economic minerals.

**OBJECTIVE:**

To familiarize the students with the economic mineral deposits and the techniques used to explore mineral and fossil fuel deposits.

**UNIT I ECONOMIC GEOLOGY 9**

Ore forming process, mineral deposits formed from magmatic, hydrothermal and volcanic process: mechanical concentration, oxidation and supergene enrichment.

**UNIT II ECONOMIC INDIAN MINERAL DEPOSITS 9**

Metallic, non-metallic deposits, study of graphite, copper, zinc, lead, gold, iron, manganese, radioactive minerals, asbestos, mica, gemstone-origin, mode of occurrence and distribution in India. Origin and occurrence of industrial minerals-ceramic, refractory, abrasive, glass and paint industry.

**UNIT III COAL AND PETROLEUM GEOLOGY 9**

Origin, physical properties, processes, occurrence of coal and its types, petroleum deposits. Fossil fuel distribution in sedimentary basins of India.

**UNIT IV GEOPHYSICS 9**

Geophysical prospecting methods – seismic, electrical, magnetic and gravity methods of mineral prospecting, Location of ore body, coal and petroleum reserves, subsurface litho-log and 3-D models.

**UNIT V REMOTE SENSING AND GIS 9**

Introduction to aerial and satellite remote sensing, identification of photo recognition elements; applications of remote sensing and GIS in geological mapping and mineral exploration.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Bateman, A.M., Economic Mineral Deposits, John Wiley and Sons, 1956
2. Krishnaswamy, S. Indian Mineral Resources, Oxford and IBH Publication Company, New Delhi, 1984.
3. Arogyaswamy, R.N.P., courses in Mining Geology, Oxford and IBH Co., New Delhi, 1988.

**REFERENCE BOOKS:**

1. Bales, R.L., Geology of the Industrial Rocks and Minerals, Harper press (India) Ltd., Faridabad, 1988.
2. Arogyaswamy, R.N.P., courses in Mining Geology, Oxford and IBH Co., New Delhi, 1988.
3. Umopathy, R.M., Text book of Mining Geology, Daltsons, 2002.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS 7**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 8**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 12**

Impact of jets - Euler's equation - Theory of rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps – working principle - work done by the impeller - performance curves - Reciprocating pump - working principle – indicator diagram – work saved by fitting air vessels – Rotary pumps – classification – comparison of working principle with other pumps – advantages.

**UNIT V TURBINES 10**

Classification of turbines – heads and efficiencies – velocity triangles – axial, radial and mixed flow turbines – Pelton wheel and Francis turbine - working principles - work done by water on the runner – draft tube - specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co.(2010)
2. Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House(p) Ltd. New Delhi(2004)
3. Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House (2002), New Delhi

**REFERENCES:**

1. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", ISBN 978-0-470-54755-7, 2011.

**CE8405****ENGINEERING SURVEYING****L T P C****3 0 0 3****AIM:**

To comprehend the principles of Surveying for efficient field operations

**OBJECTIVES:**

- To introduce Surveying and Leveling
- To introduce instruments and methods
- To offer details of Leveling
- To impart knowledge about triangulation and determination of azimuth of a survey line

**UNIT I INTRODUCTION AND LINEAR MEASUREMENTS****9**

Objectives and general principles of mine surveying, definitions of plane and geodetic surveying, Chain surveying, principles, equipment, ranging, setting and chain lines, chaining on sloping ground, errors in chaining, use of steel tape and corrections, catenary taping, corrections to measured lengths, errors in measurement, metallic, steel tapes, miscellaneous field problems relating to sighting, taping and both, field notes, record of data, plotting and computation.

**UNIT II ANGULAR MEASUREMENT****9**

Construction, testing, correction/adjustments of angle-measuring instruments-theodolite, compass, angle measurement procedures, corrections, and computations, plane and rectangular coordinates, relative applications, sources of error and field checks in traversing,

relative merits and applications of theodolite, fixed, free needle surveying, etc., limit of precision.

**UNIT III    LEVELLING** **9**

Construction, testing and adjustment of leveling instruments methods of leveling, rise and fall, height of collimation, booking, errors, computations, standards of accuracy.

**UNIT IV    TRIANGULATION** **9**

Primary, secondary, tertiary triangulation, frame work of triangles, accuracy required, setting up baseline, extension, main and check base, corrections, angle measurement methods, figure adjustment and correction, computation of triangulation scheme, transfer coordinates through two, three four point interpolation, reduction to centre(satellite station) methods, broken baseline method.

**UNIT V    TRUE NORTH FIXATION AND PLANE TABLE SURVEYING** **9**

Common terms and definitions in astronomical surveys – determination of true north, sun/star observations and connection to triangulation base line. Descriptions of plane table and accessories – adilade plumbing fork, etc., methods and use of plane table surveying, two and three point problems.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Bannister, A. and Raymond. S., Surveying, ELBS, 6th Edition 1992.
2. Kennetkar, T.P. Surveying and Levelling, Vols. 1 and 2, United Book Corporation, Pune, 2010.
3. Punmia, B.C. Surveying, Vols. 1, 2 and 3, Laxmi Publications, 2010.

**REFERENCE BOOKS:**

1. Schofield, W. Engineering Survey, Butterworth and Heinmann Publishers, 5th edition, 2001.
2. Clark, D. Plane and Geodetic Surveying, Vols.1 and 2., C. B.S. Publishers and Distributors, Delhi, 6th Edition, 1971.
3. Anderson, J.N. and Mikhail, E.M., Introduction to Surveying, McGraw Hill Book Company.

**AIM:**

To study the basic instrumentation methods

**OBJECTIVES:**

To have a knowledge of

- Electronic Instruments
- Pressure measurements
- Flow measurements
- Vibration, Viscosity and Humidity Level measurement
- Various analyzers

**UNIT I ELECTRONIC INSTRUMENTS 9**

CRO- Storage oscilloscope – Digital voltage meter (DVM) – Digital multi meter – XY Recorder, Strip chart recorder – Digital recording- Data logger – Introduction to virtual instrumentation.

**UNIT II PRESSURE MEASUREMENTS 9**

Unit of Pressure – Manometers- Different types, - Elastic type pressure gauges – Bourdon tube – Bellows – Diaphragm – Elastic elements with LVDT and strain gauge – Capacitive type pressure gauge – Measurement of vacuum – McLeod gauge – Thermal conductivity gauge – Ionisation gauge.

**UNIT III FLOW MEASUREMENTS 9**

Flow meters – Variable head type flow meter – Orifice plate – Venture tube – Positive displacement flow meter: Nutating disc, Reciprocating piston, oval gear and helix type flow meter – Rota meter – Mass flow meters.

**UNIT IV VIBRATION, VISCOSITY, HUMIDITY, LEVEL MEASUREMENT 9**

Mechanical type vibration measuring instruments – Seismic instruments as an accelerometer – Vibrometers – Viscosity – Saybolt viscometer. Humidity – Hot wire electro type hygrometer – Dew cell – Electrolysis type hygrometer.

**UNIT V ANALYSERS 9**

Dissolved Analyzer: Conductivity meter – pH meter – Dissolved oxygen analyser – Sodium

analyser – Silica analyser – Turbidity meter – Gas analyser – NOx analyser – H2S analyser – CO and CO2 monitor, Dust & Smoke measurement.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Alan S. Morriss. Principles of Measurement and Instrumentation, Print ice-Hall of India Pvt., Ltd. New Delhi, 1999.
2. Ernest O Doebelin. Measurement Systems Application & Design, Tata McGraw Hill Publishing Co., New. Delhi, 1999

**RERERENCES:**

1. Murthy, D.V.S. Transducers and Instrument and Instrumentation, Prentice Hall of India Pvt. Ltd. New Delhi.
2. Patranabir, D. Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co., New Delhi 1999.
3. Jain, R.K. Mechanical and Industrial Measurements, Khanna Publishing, New Delhi, 1999.
4. Liptak B.G. Instrumentation Engineers Hand Book (Measurement), Chilton Book Co., 1994.

**MI8401**

**MINE ENVIRONMENTAL ENGINEERING – I**

**L T P C**

**3 0 0 3**

**UNIT I MINE GASES**

**10**

Occurrence, properties, physiological effects, detection – types of instruments, construction, principle and limitations, measurement and analysis, methane layering, methane drainage. Methods of ventilation survey, Instruments required for ventilation survey,

**UNIT II MINE CLIMATE AND CONTROL**

**7**

Psychrometric properties of air, Sources of heat and humidity in mines and their effects, heat stress estimation, cooling power of mine air and methods of improving cooling power including air conditioning. Psychrometric surveys.



**UNIT III PRINCIPAL LAWS OF AIR MOVEMENT IN UNDERGROUND 8**

Fundamentals of fluid flow and its application in mine ventilation with special reference to Bernoulli's Equation, Reynolds number, Poiseuille's equation, Atkinson's equation, Karman-Prandtl equation for rough flows, resistance of mine roadways, friction and shock resistance, etc.

**UNIT IV NATURAL VENTILATION AND AIR CURRENT DISTRIBUTION IN MINES 8**

Natural ventilation, effect of depth, temperature, pressure, etc. thermodynamic treatment, distribution of air current in mines – splitting, stoppings, regulators, ventilation doors, air crossings, controlled recirculation, etc. Retrograde and boundary, ascensional, decensional, homotropical and antitropical ventilation systems, Ventilation in deep and hot mines, remedial measures.

**UNIT V MECHANICAL VENTILATION & VENTILATION PLANNING 12**

Main mechanical ventilators, booster fans and auxiliary fans, and their selection, installation, fan performance, characteristics and testing, fans in series and parallel, fan drifts and evasees, reversal of air current, forcing versus exhaust ventilation, ventilation of long headings including overlap systems. Calculation of pressure and quantity requirements, economic analysis, ventilation standards, network analysis, monitoring of mine environment. principles and computer applications.

Note: All the above are to be studied with emphasis on CMR, MMR and the relevant circulars.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Mishra, G.B. Mine Environment and Ventilation, Oxford University Press, 1992.
2. Hartman, H.L. Mine Ventilation and Air Conditioning, Wiley Interscience publication, 1993.

**REFERENCE BOOKS:**

1. Hall, C.J., Mine Ventilation Engineering, Society of Mining Engineers, New Engineers, New York, Second Edition, 1992.
2. Vutukuri, V.S., Mine Environment Engineering, Trans Tech Publishers, 1986.
3. McPherson, M.J., Subsurface Ventilation and Environmental Engineering, Chapman and Hall Publication, London, 1993.

**UNIT I INTRODUCTION 6**

Different types of motive power used in mines – their fields of application, relative merits and demerits; transmission and distribution of compressed air in mines, compressed air drills. Elements of the transport system, classification and techno-economic indices.

**UNIT II ROPE HAULAGE 12**

Wire ropes – classification, construction, fields of application, rope capping and splicing; deterioration of rope in use and its prevention; testing of ropes, selection and maintenance, rope calculations.

Rail Track and tubs– gauge; layout, curves, turnouts and cross-over, track maintenance, main features of rolling stock like tubs, mine cars man riding cars and tippers;

Types of rope haulages – merits, demerits and fields of application, constructional features, safety appliances and rope haulage calculations.

**UNIT III OTHER TRANSPORT SYSTEMS 10**

Locomotives – diesel, trolley-wire, battery locomotives, constructional features and safety devices and comparison of different types; underground and surface battery charging stations and safety measures, locomotive calculations; shuttle cars, underground trucks, load-haul-dumpers, SDL vehicles, aerial rope ways, gravity transport, principles of hydraulic & pneumatic transportation and their fields of application, electric layouts, man-riding systems.

**UNIT IV PUMPING 5**

Different types of drives, installation and maintenance of pumps and pipes in shafts and roadways, electrical layouts, various sources of water in mines, design of sumps.

**UNIT V MINE ELECTRICAL ENGINEERING 10**

Distribution of electric power in mines, types of mine cables and their fields of applications, mining switch gears and their installation in hazardous atmosphere, flame proof enclosures, intrinsically safe circuits, (examples) safety aspects and signalling. Mine telephone system and latest development in mine communications.

Note: All statutory aspects like CMR, MMR and the relevant DGMS circulars are to be covered by the faculty.

**TOTAL: 45 PERIODS**

## REFERENCE BOOKS:

1. Cherkassky, B.M., Pumps, Fans, Compressors, MIR Publishers, 1980.
2. Deshmukh, D.J., Elements of Mining Technology, Vol. I and II EMDEE Publishers, Nagpur, 1989.
3. Walker, S.C., Mine Winding and Transport, Elsevier, 1988.
4. Karelin N.T., Mine Transport, Orient Longmans, N. Delhi.
5. Mason, E., Coal Mining Series, Mining Machinery, Virtue and Company Ltd., London.
6. Statham, I.C.F., Coal Mining, Vol. I, II, III and IV, Caxton Eastern Agencies, Calcutta.

**MI8403**

**SURFACE MINING**

**L T P C**

**3 0 0 3**

## AIM:

To give the student complete knowledge on layout, design and planning of opencast mines.

## OBJECTIVES:

1. To develop an understanding of surface mining equipments and its operations in a surface mine.
2. To achieve the ability to classify and select surface mining methods.
3. To understand the slope failures in a surface mine and study the concept of waste dump formations.

## UNIT I INTRODUCTION

**5**

Status of surface mining, types of surface mines, applicability and limitations, compilation of basic data, concept of stripping ratio, stripping economics, concept of ultimate pit limits, design of haul roads, elements of surface mine planning.

## UNIT II LAYOUT AND DESIGN OF SURFACE MINES

**10**

Selection of site for box cut, selection of operating parameters like bench height, width, slope, etc., Working pit slope and ultimate pit slope, various modes of slope failures, factors influencing slope stability, development of opencast mine layouts, stripping methods using different machinery, Various layout problems and their solutions. Conversion of Underground mine to opencast mines.

## UNIT III GROUND PREPARATION METHODS

**6**

Preparation of the site – Ripping, Drilling and Blasting; Types, operation, selection, applications

and limitations of ground preparation equipments – Rippers, Dozers, Blasthole drills and rock breakers, Placer mining and hydrolucking. Economics of Drilling and blasting.

**UNIT IV EXCAVATION SYSTEM IN SURFACE MINES 12**

Selection criteria for excavation / loading and material transport equipment used in surface mines. Classification, construction, capacity, operation, productivity and application of different types of excavating / loading equipment used in surface mining projects - Shovels, Draglines, Front end loaders, Scrapers, Bucket wheel and bucket chain excavators, Surface miners. Problems of Deep open cast mining.

**UNIT V TRANSPORT AND WASTE DUMPS 12**

Scope and application of different modes of transport system in surface mines – Trucks, Conveyors (shiftable and high-angle), Aerial ropeways, Rail transport and Pipeline transport systems. Scope and application of in-pit crushers in surface mines. Types of waste dump – internal and external; dump formation methods and corresponding equipment; Dump stability and stabilisation measures.

**TOTAL: 45 PERIODS**

Note: All Statutory aspects like CMR, MMR and relevant DGMS circulars are to be covered by the faculty.

**TEXT BOOKS:**

1. Kennedy, B.A., Surface Mining – 2nd Edition, SME, New York, 1990.
2. Hartman H.L., Introductory Mining Engineering, John Wiley and Sons, 2002.
3. Hartman, H.L. (Ed.), SME Mining Engg. Handbook Vol. I and II, Society for Mining, Metallurgy, and Exploration, Inc., Colorado, 1992.
4. Pfeleider, E. P, Surface Mining, 1st Edition, New York, 1968.
5. Konya, C.J. and Walter, E.J., Surface Blast Design, New Jersey, 1990.
6. Rzhovsky V., Open pit Mining Operations, Mir Publications, 1971.

**REFERENCES:**

1. Amitosh De, Heavy Earth Moving Machinery, Lovely Prakashan, Dhanbad, 2000.
2. Hustrulid, W. and Kuchta, M, Open Pit Mine Planning & Design, Vol. 1, Fundamentals, Balkema, Rotterdam, 1998.
3. Singh, R.D., Principles and Practices of Modern Coal Mining, New Age International (P) Ltd., Publishers, 1997.
4. Mishra G.B., Surface Mining, Dhanbad Publishers, Dhanbad, 1990.

5. Hustrulid, W. A., Mccarter, M. K., And Van Zyl, D. J. A., Ed., Slope Stability in Surface Mining, Littleton, 2000.
6. Hoek, E., and Bray, J. W., Rock Slope Engineering, 3rd edition., Institution of Mining and Metallurgy, London, 1974.
7. Das, S.K., Surface Mining Technology, Lovely Prakashan, Dhanbad, 1994.

**AG8411**

**GEOLOGY LABORATORY – I**

**L T P C**

**0 0 2 1**

**UNIT I MINEROLOGY**

**6**

Identification of physical properties of quartz and feldspar varieties, hypersthene hornblends, augite, mica, asbestos, barite, calcite, fluorite, tourmaline, beryl. Study of Moh's scale of hardness.

**UNIT II PETROLOGY**

**6**

Identification and description of igneous rocks – plutonic, hypabyssal and volcanic type of rocks: Sedimentary rocks – rudites, arenites, carbonates and argillites, metamorphic rocks – gneiss, marble, slate, schist, quartzite.

**UNIT III STRUCTURAL GEOLOGY**

**6**

Exercises on structural maps of geological site and interpretation of geological conditions; 3 point and 4 point bore hole problems to decipher the subsurface geological conditions for mining of resources.

**UNIT IV GEOLOGICAL MAPPING METHODS**

**6**

Topo sheets, Map scale – types, preparation and interpretation of contour maps, drainage maps, symbols, rock and geological structures, use of clinometers, Brunton compass and knowledge on GPS.

**UNIT V GEOLOGICAL FIELD WORK**

**6**

Geological mapping of igneous, sedimentary and metamorphic terrains. Identification of minerals and ores in the field site. Recognition of geological structures – fault, fold joint in the field.

**TOTAL: 30 PERIODS**

**OBJECTIVES:**

Students should be able to verify the principles studied in theory by performing the experiments in lab.

**A. Flow Measurement**

1. Calibration of Rotometer
2. Flow through Venturimeter
3. Flow through a circular Orifice
4. Determination of mean velocity by Pitot tube
5. Verification of Bernoulli's Theorem

**B. Losses in Pipes**

6. Determination of friction coefficient in pipes
7. Determination of losses due to bends, fittings and elbows

**C. Pumps**

8. Characteristics of Centrifugal pumps
9. Characteristics of Gear pump
10. Characteristics of Submersible pump
11. Characteristics of Reciprocating pump

**D. Turbines**

12. Characteristics of Pelton wheel turbine
13. Characteristics of Francis turbine

**E. Determination of Metacentric height**

14. Determination of Metacentric height

**TOTAL: 45 PERIODS**

**REFERENCE BOOKS:**

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2000.

3. Subramanya, K.. Flow in open channels, Tata McGraw - Hill pub. Co., 1992.
4. Subramanya, K. Fluid mechanics, Tata McGraw- Hill pub. Co., New Delhi, 1992.

**ME8412**

**BASIC MECHANICAL ENGINEERING LABORATORY  
FOR MINING EXPERIMENTS**

**L T P C  
0 0 4 2**

**THERMAL EXPERIMENTS**

1. Study of I.C. engines and components
2. Performance test on 4 S diesel engine
3. Performance test on reciprocating air-compressor
4. Study of refrigeration system
5. Natural and forced convection studies

**ENGINEERING DESIGN**

1. Cam displacement and velocity analysis
2. Whirling of shaft-determination of critical speed of shaft with concentrated loads
3. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
4. Vibrating system – spring mass system – determination of damping co-efficient of single degree of freedom system.
5. Transverse vibration – free – beam, determination of natural frequency and deflection of beam.
6. Study of Gears and linkage mechanisms

**MA8501**

**STATISTICS AND NUMERICAL METHODS**

**L T P C  
3 1 0 4**

**UNIT I TESTING OF HYPOTHESIS 9**

Sampling distributions - tests for single mean, proportion, difference of means (large and small samples) – tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

**UNIT II ANALYSIS OF CORRELATION, REGRESSION DESIGN OF EXPERIMENTS 9**

Correlation – Types of Regression - Completely randomized design – randomized block design – latin square design - 22 - factorial design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9**

Newton-Raphson method - Gauss elimination method – pivoting - Gauss-Jordan methods – iterative methods of Gauss-Jacobi and Gauss-Seidel - matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by power method.- Curve Fitting – Method of Group Averages – Method of least squares

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9**

Lagrange’s and Newton’s divided difference interpolation –Newton’s forward and backward difference interpolation - approximation of derivatives using interpolation polynomials - numerical integration using trapezoidal and Simpson’s 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9**

Taylor’s series method - Euler’s method - modified Euler’s method - fourth order Runge-Kutta method for solving first and second order equations - Milne’s predictor-corrector methods for solving first order equations - finite difference methods for solving second order equations.

**TOTAL:45+15**

**TEXT BOOKS:**

1. Johnson, R.A., and Gupta,C.B., Miller and Freund’s Probability and Statistics for Engineers, Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal, J.S., Numerical Methods in Engineering and Science, 6th Edition, Khanna Publishers, New Delhi, 2004.

**BOOKS FOR REFERENCES:**

1. Walpole, R.E., Myers,R.H., Myers,S.L., and Ye.K.,, Probability and Statistics for Engineers and Scientists, Pearson Education, Asia , 8th edition, 2007.
2. Spiegel, M.R., Schiller, J., and Srinivasan, R.A., Schaum’s Outlines on Probability and Statistics, Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. Numerical Methods for Engineers, 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., Applied Numerical Analysis, 6th Edition, Pearson Education Asia, New Delhi, 2006.



**UNIT I ENVIRONMENT & ECOLOGY 9**

Concept of Ecology, ecological principle, nature of the environment ecology and man. Goals, strategies and tools for environmental management – systems approach to environmental management – environmental guideline – National Policies on environment with respects to mining activities – Global and Local environmental issues – resource degradation – desertification – Industrialization, Objectives of Sustainable Development.

**UNIT II ENVIRONMENTAL POLLUTION - I 9**

Environmental Pollutants due to surface and underground Mining – Air, Water, Noise, Sources and Classification of pollutants including dust and their effect on human health, Sources, hazards, sampling and analysis, standards, instrumentation and measurement of pollutants including dust, Control and preventive measures for air pollution including for dust, Structure of the atmosphere – ozone layer depletion – Acid rain – Green house gases and global warming Ambient Air quality and emission standards, Air quality Sampling and monitoring, Dispersion of air pollutants,

**UNIT III ENVIRONMENTAL POLLUTION - II 9**

Environmental Pollution due to Water - Sources and Classification of pollutants and their effect on human health, hazards, sampling and analysis, Water pollution standards, Noise standards – Measurement – Noise Impact Index assessment, Control and preventive measures for water, noise pollution. Pollution due to vibrations their monitoring, prevention and control, Land pollution, land for alternation dealing with mind out land , re-vegetation, tailing management, tailing dams, method and construction, land use plan, Mine closure planning. Textural classification and properties of soil. Impact of pollution on human health, miner's diseases and their social impact.

**UNIT IV ENVIRONMENTAL MANAGEMENT 9**

Environmental quality objectives, Emission and ambient standards – Minimum National standards – International environmental standards – ISO 14000 – EIA Notification – Sitting of Industries – Environmental management plans, Environmental impact assessment, Environmental management system audits, Environmental economics – Principles of cost benefit analysis – Valuing the Environment – Environmental Accounting, Environmental administration- training awareness and competence,

## **UNIT V ENVIRONMENTAL LEGISLATIONS**

**9**

Environmental laws, the Environmental (Protective) Act, 2004, The Water Act (1974), The Air act (1981), The Forest Act 1927, The forest conservation act 1980, Power and responsibilities of regulatory agencies and occupation consent to establish and operate wild life protection act and rules , Environmental clearance procedure for a mining Project.

**TOTAL: 45 PERIODS**

### **TEXT BOOKS:**

1. Hartman, H.L. Mine Ventilation and Air Conditioning, Wiley Interscience publication, 1999.
2. Mishra, G.B. Mine Environment and Ventilation, Oxford University Press, 1992.
3. McPherson, M.J. Subsurface Ventilation and Environmental Engineering, Chapman & Hall Publication, London, 1993.
4. Manahan S.E. Environmental Science and Technology.
5. Mackenthun, K.M. Basic Concepts in Environmental Management, Lewis Publications, London, 1998.
6. Shyam Divan and Armin Rosencranz, Environmental Law and Policy in India, Oxford University Press, New Delhi. (2001)

### **REFERENCES:**

1. Gregor I. McGregor. Environmental Law and Enforcement, Lewis Publishers, London, 1994.
2. Noel de Nevers, Air Pollution Control Engg., McGraw Hill, New York, 1995
3. Anjaneyulu, Y. Air Pollution & Control Technologies, Allied Publishers (P) Ltd, India, 2002.
4. Nick Hanley, Jaison F. Shogren and Ben White. Environmental Economics – In Theory and Practice, Macmillan India Ltd, New Delhi, 1999.
5. Roger Perman, Yue Ma and James McGilvray. Natural Resources and Environmental Economics, Second edition, Addison Wesley Longman Ltd, Singapore, 1997.
6. Christopher Sheldon and Mark Yoxon, Installing Environmental Management System – a step by step guide, Earthscan Publications Ltd, London, 1999.
7. Lee Kuhre, ISO 14001 Certification –Environmental Management Systems, Prentice Hall, USA, 1995.

**UNIT I UNDERGROUND SURVEY AND MODERN SURVEYING METHODS 14**

Special features of Underground Mining surveying; Correlation of Surface and underground mine workings; operational details and applicable errors in each; methods of transferring levels to different landings/ levels/ horizon; Illustrative examples: Measurement of shaft depth

Application of Remote sensing and photogrammetry in exploration and mining; EDM; Electronic theodolite, Electronic Tachometer (Total station); Laser Theodolite; GPS; GIS; DTM Applicability and limitations.

**UNIT II ADJUSTMENT OF SURVEY MEASUREMENT 10**

Most probable value, laws of weights; principle of least square; uncorrelated values of unequal precision; Adjustment of figures – Simple triangle, two connected triangles, crossed quadric lateral, hubangle correction (polygon); errors and adjustment in steep sights; striding level; Application of top eccentric and side eccentric telescopes Illustrative examples:

**UNIT III ALIGNMENT SURVEY AND TACHOMETRY 10**

Alignment / Gradient control of vertical and inclined shafts; gradient control in development openings; Holing surveys; Application of appropriate methods, equipment, operational control; Alignment in Headgears, machinery foundation etc Illustrative examples:

**UNIT IV STOPE & SUBSIDENCE SURVEYS AND .MINE PLANS 9**

Stope survey – objectives, methods, preparation of stope plan, preparation of mine plan subsidence survey – Subsidence trough, factors influencing subsidence, protective pillars, guidelines subsidence in laying out monitoring stations, methods of survey, statutory provisions and circulars.

Preparation of Mine plans and sections; stepped plan; Allay plan; Duties and responsibilities of mine surveyor under mines act and connected legislations.

**UNIT V CONTOURING AND CURVE SETTING MISCELLANEOUS SURVEY APPLCIATIONS 17**

Methods of Contouring; contour gradient; uses of contours; Reservoir / Catchment area calculations Illustrative examples: setting out underground / curves; need for curves; types of curves; methods of curve setting

Dip/ Strike / Fault interpretation from inclined angle vertical borehole data in dipping and plunging formations; interpretations of borehole maps; borehole deviation; calculation of plunge in folded terrain.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Winniberg, F., Metalliferous Mine Surveying
2. Punmia, B.C., Surveying Vol I and II, Laxmi Publication, New Delhi, 1991
3. Kenetkar, T.P., Surveying and Levelling, Vol I and Vol II, United Book Corporation, Poona, 1991.

**REFERENCES**

1. Mason,E., Coal Mining Series, Surveying ,Vol I And Vol II, Virtue And Company Limited, London.
2. Clark, D., Plane And Geodetic Surveying,Vol I And Vol II, CBS Publishing Co., 1986.
3. Assur,V.L.And Pilatov,A.M., Pratical Guide To Surveying MIR Publishers, Moscow 1988.
4. Borshch,V., Komponiets,A., Navitny, G.And Knysh., Mine Surveying MIR Publishers Moscow,1989.
5. Sahni, Advanced Surveying, Lovely Prakashan, Dhanbad, 1992.
6. Alam Chand., Modern Concept Of Mine Survey, Lovely Prakashan, Dhanbad,1992.
7. Ghatak., Mining Surveying, Lovely Prakashan,Dhanbad,1990

**MI 8503**

**MINERAL PROCESSING**

**L T P C**

**3 0 0 3**

**UNIT I INTRODUCTION**

**6**

Scope, objectives, minerals/ores for mineral processing, methods of treatment, choice of methods, sequence of operations, product, flow sheets, ore sorting – hand mechanical, electronic, removal of harmful materials, ore transportation.

**UNIT II COMMINATION**

**8**

Introduction to comminution, primary/secondary/tertiary crushing, purpose, duty, theory of crushing, crushing sequence, reduction ratio, types of crushers and comparison, general crushing flow sheet, wet/dry grinding, mechanism and various affecting parameters.

**UNIT III      LABORATORY & INDUSTRIAL SIZING AND SAMPLING AND CONTROL      11**

Purpose, factors governing particle behaviour, laboratory and industrial screens, trommels, vibrating screens, etc. wet and dry screening, classification, classifiers.

Purpose, sampling - solid ore, pulp, head feed, grinding circuit samples, flotation products, etc., X-ray fluorescence, automatic sampling. Metallurgical accounting.

**UNIT IV      SEPARATION/CONCENTRATION      10**

Newton's and Stoke's Laws of particle settlement, different concentration techniques – gravity, chemical froth flotation, wet & dry magnetic separation, electromagnetic, amalgamation, heavy media, jigging, shaking tables, sluicing, spirals, thickeners, filtration, etc., coal washing.

**UNIT V      SPECIAL METHODS      10**

Chemical extraction, cyanide process, leaching, use of ion exchange, solvent extraction, pilot plant studies on ores, tailing dams; generalised plant practice/flow sheets for coal and other important ores – copper, aluminium, lead, zinc, silver, gold, uranium, iron, limestone, magnesite.

**TOTAL:45 PERIODS**

**REFERENCES:**

1. Jain, S.K., Ore Processing, Oxford – IBH Publishing, 1984.
2. Gaudin, A.M., Principles of Mineral Dressing – McGraw Hill Book Company, 1971.
3. Taggart, A.F., Handbook of Mineral Dressing, John Wiley and Sons, New York, 1990.
4. Wills, B.A. Mineral Processing Technology, Pergamon Press, 1985.
5. Vijayendra, H.G., Handbook on Mineral Dressing, Vikas Publishing House Pvt. Ltd. 1995.

**MI 8504**

**MINING MACHINERY - II**

**L T P C**

**3 0 0 3**

**UNIT I      WINDING ENGINES      10**

Winding systems, drum winders, drives, mechanical braking of winders, safety devices in winding, over wind and over speed protection, Koepe and multi-rope friction winding, electrical layouts. Duty cycles of drum winders of different drum cross sections. Special problems of deep shaft winding.



**UNIT I INTRODUCTION 12**

Definition of some important terms used in rock mechanics, application of rock mechanics in mining, introduction to stress analysis, principal stresses and strains, differential equations of static equilibrium.

**UNIT II PHYSICAL PROPERTIES OF ROCKS AND ROCK INDICES 6**

Physical properties of rock – density, porosity, moisture content, permeability, swell index, slake durability index, thermal conductivity, hardness, durability, Protodyaknov index, impact strength index, point load index, rock mass classification.

**UNIT III MECHANICAL PROPERTIES OF ROCKS 12**

Preparation of test specimens, laboratory determination of mechanical properties of rocks, compressive strength, tensile strength, shear strength, modulus of elasticity, Poisson's ratio, triaxial strength of rocks, Mohr's envelope, effect of various parameters on the strength of rocks, in-situ strength, effect of joints and fracture on mechanical properties of rocks.

**UNIT IV NON-DESTRUCTIVE TESTING METHODS AND TIME DEPENDENT PROPERTIES OF ROCKS 6**

Dynamic wave velocities, dynamic elastic constants, their determination in the laboratory, application in mining, time dependent properties of rocks, creep, mechanism of creep of rocks – different stages, rheological models.

**UNIT V UNDERGROUND SUPPORTS 9**

Various methods of roof examination, pressure arch theory, ground forces and field stresses, mechanism, objectives and limitations of supports, conventional supports – column type, timber sets, arches, yielding type; rock and cable bolting, rock grouting, shotcreting, roof stitching, support of shaft bottoms, galleries, junctions and places of roof falls, design of supports, longwall powered supports. Design of systematic support rules for B & P Development, depillaring LW gate readings and extraction.

**TOTAL : 45 PERIODS**







**UNIT IV      GEOLOGICAL FIELD WORK****6**

Geological mapping of igneous, sedimentary and metamorphic terrains. Identification of minerals and ores in the field site. Recognition of geological structures - fault, fold joint etc. in the field.

**TOTAL: 30 PERIODS****REFERENCE BOOKS:**

1. Bateman, A.M., Economic Mineral Deposits, John Wiley and Sons, 1956.
2. Krishnaswamy, S. Indian Mineral Resources, Oxford and IBH Publication Company, New Delhi, 1984.
3. Bell F.G., Engineering Geology, Elsevier Publications, 2007.

**EE8514                      INSTRUMENTATION ENGINEERING LABORATORY****L T P C  
0 0 2 1**

1. Familiarization of Basic measuring instruments
2. Analysis of various Bridge circuits
3. Characteristics of amplifiers, A/D converters
4. Characteristics of active filters
5. Characteristics of strain gauge circuits.
6. Characteristics of LVDT
7. Characteristics of RTD and vibrating wire instruments
8. Characteristics of Thermo couple and LDR
9. Characteristics of Pressure to current converters.

**MI 8511                                      PRACTICAL TRAINING - II****L T P C  
0 0 0 1****AIM:**

To provide training in mines for gaining thorough understanding of all the theoretical knowledge.

Gaining practical experience is an important aspect of the mining engineering programme having many characteristic features of its own.

The students have to undergo training in mines during the summer vacation at the end of the IV Semester for a period of 4 weeks and obtain a valid certificate from the competent authority of the organisation provide training. The students have to submit a report on the training which would be evaluated during the ensuing V Semester. This carries a total of one credit during the V Semester. Evaluation would be done by a faculty or a group of faculties on different marking heads such as training, viva voce report etc., or other approved evaluation systems.

Normally a student is not permitted to withdraw from the practical training. In case of any unforeseen circumstances / valid reasons if he could not undergo the training as scheduled, on the recommendation of the Head of the Department and approval by the competent authority the student may be permitted to undergo Practical Training-II before proceeding to VII Semester The decision of the competent authority is final.

**MI8512**

**SURVEY LABORATORY – I**

**L T P C**

**0 0 4 2**

1. To study and understand the parts and terms common to different survey instruments such as chains, different types of tapes, prismatic compass, trough compass, and to learn to measure distance and magnetic bearing.
2. To fix a closed traverse on the ground, measure the length with a steel tape and magnetic bearing of the sides using a miner's dial, calculate the included angles, testing permanent adjustments of a theodolite. .
3. To learn the use of different types of theodolites, testing permanent adjustments of a theodolite, layout of a closed traverse, calculate the partial and total coordinates, closing error, distribute the closing error applying Bowditch rule and recalculate the coordinates - calculate the magnetic bearings of the lines, heights and distances, exercises.
4. Study of levels- establishing the difference in levels between points using both rise and fall and height of collimation methods.
5. To carry out leveling on a given line and prepare longitudinal section, run a fly level between two far off points and calculate the difference in height.
6. Measurement of base line, applying corrections, conduct a triangulation survey of a figure involving a braced quadrilateral and adjust the angles - calculation of true bearing, measure and compare with check base.
7. To study plane table and its accessories to carry out the plane table survey of the area using radiation, intersection, traversing and resection methods, two point problem and three point problems of plane table surveying.

**AIM :**

To provide a clear understanding of basic management principles that leads to corporate building.

**OBJECTIVE :**

To deliver the principles of management, functions of management, organizational structure and dynamics, modern concepts of Industrial Management.

**UNIT I INTRODUCTION 9**

Technology Management – Definition – Functions – Evolution of Modern Management – Scientific Management – Development of Management thought. Approaches to the study of Management, Forms of Organization – Individual Ownership – Partnership – Joint Stock companies – Co-operative Enterprises – Public sector Undertakings, Corporate Frame Work – Share Holders – Board of Directors – Committees – Chief Executive – Constraints – Environmental – Financial – Legal – Trade Union.

**UNIT II FUNCTIONS OF MANAGEMENT 9**

Planning – Nature and Purpose – Objectives – Strategies – Policies and Planning Premises – Decision Making – Organizing – Nature and Process – Premises – Departmentalization – Line and Staff – Decentralization – Organizational culture – Selection and training – Placement – Performance appraisal – Controlling – Process of Controlling – Controlling techniques – Preventive control, industrial safety.

**UNIT III ORGANIZATIONAL BEHAVIOUR 9**

Definition – Organization – Managerial Role and functions – Organizational approaches, individual behavior – Causes – Environmental effect – Behaviour and Performance, Perception – Organizational implications. Personality – Contributing factors – Theories of motivation – Job satisfaction – Learning Curves, Work Design and approaches.

**UNIT IV GROUP DYNAMICS 9**

Group behavior – Groups – Contributing factors – Group norms – Communication – Process – Barriers to communication – Effective communication leadership – Managerial Grid – Leadership Role in Group Decision, Group Conflicts – Types – Causes – Conflict Resolution – Inter group relations and conflict organization – Centralization and decentralization – Formal and informal – Change Process – Resistance to change – Culture and Ethics.

## **UNIT V MODERN CONCEPTS**

**9**

Management by objectives (MBO) – Management by Exception (MBE) – Developing strategies, information technology in management – Decision support system – Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) – Supply Chain Management (SCM) – Activity based management (ABM) – Globalization.

**TOTAL: 45 PERIODS**

### **TEXT BOOK**

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India Pvt. Ltd., Ninth edition, 2008.

### **REFERENCES**

1. Herald Knottz and Heinz Wehrich. Essentials of Management, McGraw Hill Publishing Company, Singapore International Edition, 1980.
2. Chandran, S. Organizational Behaviour, Vikas Publishing House Pvt. Ltd., 1994.
3. Ties, A.F. Stoner and R. Edward Freeman, Management, Prentice Hall of India Pvt. Ltd. New Delhi 110 011, 1992.
4. Joseph J. Massie, Essentials of Management, Prentice Hall of India Pvt. Ltd., 1985.

**MI8601**

**COMPUTER APPLICATIONS IN MINING**

**L T P C**

**3 0 0 3**

### **AIM:**

To impart skills on designing and development of mining software and appreciate the scope of Computer application in Mining

### **OBJECTIVES:**

1. To impart knowledge on hardware and software issues concerned with computers in mining industry.
2. To develop algorithms and programs on various mining related problems
3. To impart knowledge on high-end simulation methodologies
4. To study modern techniques on solving mining problems.

## **UNIT I INTRODUCTION TO COMPUTERS**

**8**

Hardware concepts – CPU architecture and developments – Overview on input, output and memory devices – interfacing concepts; evolution of operating systems; operating systems

functions, characteristics – distributed operating system – Cloud computing / grid computing in mining.

**UNIT II SOFTWARE 8**

Application of structured and object oriented programming languages to mining problems like pillar design, blast design, subsidence etc., - modular programming – Top down and bottom approach for mine design and planning.

**UNIT III DATABASE MANAGEMENT SYSTEMS 7**

Database and Relational database - development of software packages for mining companies – forms, queries and reports - management information system – enterprise resource planning for production machineries, manpower, finance , and other mining operations.

**UNIT IV PROBLEM SOLVING – APPLICATIONS IN MINING 14**

Ventilation network analysis; online and offline monitoring and control. MINOS, FIDOS. CAD in mining – geostatistics, reserve estimation, krigging, block modeling and orebody modeling, pit design and optimization, mine scheduling, TDS, blast design etc., digitization and scanning of mine maps - GIS in mining.

**UNIT V MODERN TRENDS 8**

Computer graphics and virtual reality, artificial intelligence, expert system, neural networks, simulated annealing, robotics and their applications in mining.

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. R.V.Ramani – Editor, APCOM Proceedings Application of Computers and Operations Research in the Mineral Industry, The Society of Mining, Metallurgy and Exploration, Inc.,1996
2. Kadri Dagdelen, Editor, Computer Applications in the Minerals Industries, Colorado School of Mines, 1999.
3. Ramani R.V., et al. Computers in Mineral Industry, Oxford and IBH Publishers, 1994.
4. Fytas, K. and Singhal, R.K. Computers Applications in Mineral Industry, A.A.Balkema Publication, 1988.
5. E Balagurusamy , Fundamentals of Computers , Mc Graw Hills Publication, 2009
6. Basandra S K, Computers Today Fourth Edition, Galgotia Publications Pvt. Ltd, 2004

**AIM:**

To impart knowledge on various approaches used in tackling mining problems.

**OBJECTIVES:**

1. Introducing the various instrumentation and measurement methods.
2. To study the theories of failure and approaches used for open pit and underground designs.

**UNIT I ROCK MECHANICS INSTRUMENTATION****6**

Conventional testing machines and servo-controlled stiffness testing machines, load cells, strain gauges, flat jacks, convergence indicators, anchorage testing equipment, sag bolts, etc, in situ measurements.

**UNIT II PIT SLOPE STABILITY & SUBSIDENCE****10**

Approach to slope stability, slope parameters, Geological and physico-mechanical parameters affecting slope stability, effect of water pressure, determination of factor of safety, introduction to methods of failure analysis.

Theories of subsidence, factors affecting subsidence, subsidence surveys, subsidence prediction techniques, subsidence control – surface and underground measures, pseudo-mining damage.

**UNIT III THEORIES OF FAILURE OF ROCKS & PILLAR DESIGN AND ROCK BURST****12**

Different theories of failure of rocks, modes of failure - Griffith, Coulumb, Navier, Mohr's, Hoek-Brown, etc.

Strength of pillars, barrier and shaft pillars design – load estimation, factor of safety, various formulae, rock burst, bumps.

**UNIT IV DESIGN OF UNDERGROUND WORKINGS****9**

Stress distribution in underground workings, design of underground openings, measurement of rock movements, engineering rock mass classification, rock load assessment and support design, introduction to numerical methods of geomechanics; scaled model studies – principles of modeling and model material and testing.

**UNIT V STOWING/FILLING****8**

Principal methods of stowing, collection, preparation and transport of materials, surface, underground and face arrangements, design of stowing plants.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Obert, L. and Duvall, W.I., Rock Mechanics and Design of Structure in Rock John Wiley and Sons Inc., New York, 1967.
2. Vutukuri, V.S. and Lama, R.D., Handbook on Mechanical Properties of Rocks, Vol.I, II, III and IV, Transtech Publication Berlin, 1974/78.
3. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
4. Hoek, E and Brown, E.T., Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980.
5. Peng, S.S. Ground Control, Wiley Interscience, New York, 1987.
6. Jumkis, A.R. Rock Mechanics, Transtech Publications, Berlin, 1983.
7. Stacey, T.R. and Page, C.H., Practical Handbook for Underground Rock Mechanics, Transtech Publications, Berlin, 1986.
8. Whittaker, B.N. and Reddish, D.J., Subsidence – Occurrence, Prediction and Control – Elsevier Science Publishers, the Netherlands, 1989.

**MI 8603****UNDERGROUND MINING METHODS - METAL****L T P C****3 0 0 3****AIM:**

To impart detailed knowledge about metal mining methods and technology.

**OBJECTIVE:**

1. To introduce concepts of metal mining and metal mining terminology.
2. To study development and operations of metal mines.
3. To study about special methods of metal mining methods.



<b>UNIT I</b>	<b>BASICS</b>	<b>9</b>
Metal Mining Terminology; Typical modern metal mine features; typical pre stoping ore block constructional features; classification of methods; Techno economic characteristics impacting on choice of method; Typical unit cost parameters; optimum size of mine and stope.		
<b>UNIT II</b>	<b>GENERAL MINE DESIGN</b>	<b>9</b>
Mode of mine and stope entry; Layouts; optimum production; Basic design – Level Intervals, ore pass, common ore pass, size of blocks ore handling in stope and other openings, overview of constructional features – X cuts, Raises, Winzes etc.		
<b>UNIT III</b>	<b>STOPING – GENERAL DESCRIPTION</b>	<b>9</b>
Unsupported methods – Room and pillar, shrinkage, sublevel stoping etc. Supported stopes – Cut and fill, square set etc. Caving methods – Top slicing, sublevel caving, block caving.		
<b>UNIT IV</b>	<b>STOPE PLANNING AND LAYOUT</b>	<b>9</b>
Preparing a stoping block; sequence of stoping; organization; production cycle; unit cost calculation; comparison of methods and costs		
<b>UNIT V</b>	<b>NOVEL INNOVATIVE TECHNIQUES &amp; SPECIAL APPLICATIONS</b>	<b>9</b>
Rapid excavation; Hydraulic mining; slurry mining; solution mining; Radial – axial splitter; Thermal fragmentation; shock wave breaking; Nuclear mining. Deep mining; narrow contiguous veins; shaft and remnant pillars; VCR; Ring drilling; Large Blast hole stoping. Case studies of Indian and foreign underground metal mines.		
Note: All the above are to be studied with emphasis on MMR and the relevant circulars		
		<b>TOTAL: 45 PERIODS</b>
<b>REFERENCES:</b>		
1. Cummings, A.B. and Given, I, V., SME Mining Engg. Handbook Vol. I And II, Society Of Mining Engineers Of American Institute Of Mining, Metallurgical, Petroleum Engineers Inc., New York 1992.		
2. Hartman, H.L., Introductory Mining Engineering, John Wiley and Sons, New York, 1987.		
3. Hustrulid, W.A. Ed., Underground Mining Methods Handbook Society of Mining Engineering, AMIE, New York, 1990.		

**(Common to all branches of Fifth or Sixth Semester  
B.E / B.Tech programmes)**

**Objectives**

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
  - To help them improve their soft skills, including report writing, necessary for the work-place situations
1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
  2. Creating effective PPTs – presenting the visuals effectively
  3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
  4. Preparing job applications - writing covering letter and résumé
  5. Applying for jobs online - email etiquette
  6. Participating in group discussions – understanding group dynamics - brainstorming the topic
  7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD
  8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
  9. Attending job interviews – answering questions confidently
  10. Interview etiquette – dress code – body language – mock interview

**TOTAL: 30 PERIODS**

**Reference Books**

1. Dhanavel, S.P. 2010. English and Soft Skills. Hyderabad: Orient BlackSwan Ltd.
2. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. Group Discussion and Team Building. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. The ACE of Soft Skills. New Delhi: Pearson, 2010.

5. Gulati, Sarvesh. Corporate Soft Skills. New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker. Presentation Skills for Students. New York: Palgrave Macmillan, 2004.

### **Extensive Readers**

1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 1989.
2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.

### **Web Resources**

1. [www.humanresources.about.com](http://www.humanresources.about.com)
2. [www.careerride.com](http://www.careerride.com)

**MI 8611**

**MINERAL PROCESSING LABORATORY**

**L T P C**

**0 0 2 1**

1. Study of grab sampling and different sample division techniques like coning and quartering, riffle sampling techniques, etc.
2. Determination of crushing characteristics of a given mineral sample using jaw crusher
3. Determination of the grinding characteristics of a given mineral sample using ball mill
4. Sieve analysis of a given sample and to calculate (a) percentage sample retained on screens (b) average size of sample material and (c) to plot sizing curves
5. Concentration of a given mineral sample using mineral jig
6. Concentration of a given mineral using Wilfley table
7. Concentration of a given mineral using froth flotation cell
8. concentration of a given mineral using magnetic separator
9. Study of washability characteristic of a coal sample using float and sink test.
10. Study of sedimentation characteristics of a given sample

**MI8612**

**MINING MACHINERY LABORATORY**

**L T P C**

**0 0 2 1**

1. Study of construction of different types of wire ropes and Types of rope chapels used for rope haulages & winding, safety hooks used in winding.
2. Construction and operation of compressed air operated drills
3. Study of different types of haulage systems – tensioning arrangement in endless haulage and different types of haulage clips and other means of attachment of tubs to the rope.



**MI8614**

**SURVEY LABORATORY- II**

**L T P C**

**0 0 4 2**

1. Enlarging/reducing a given plan to a prescribed scale by the method of least squares and using pantograph/ediograph.
2. Simulate conditions for a correlation, survey on surface and find out the bearing and distance of a base line by different methods.
3. Simulate conditions in surface and conduct alignment surveys of drives and transfer of surveys through winzes and raises.
4. Contour a given area with reference to a benchmark and base line by trigonometric levelling and calculate the volume between two given reduced levels.
5. Establish a base line on the ground using a theodolite with reference to two elevated points whose coordinates are known but on which instrument cannot be set. Compare the calculated distance of the baseline with actual measurement.
6. Establish the true bearing of a baseline by observing a circumpolar star by the method of equal altitudes, extra-meridian observation of the Sun for the calculation of azimuth.
7. Heights and distances using tacheometric surveying - tangential, subtense, stadia methods.
8. Correlation surveys carried at different levels and transfer of survey points from one level to another through vertical shafts.
9. Use of modern surveying equipment including experience in using application software.
10. Transfer of base line from one level to other by correlation.
11. Visit to Remote Sensing Centre for getting conversant with use of stereoscope for mine plan preparation.

**MI 8701**

**MINE ECONOMICS AND INVESTMENT**

**L T P C**

**3 0 0 3**

**UNIT I INTRODUCTION**

**4**

Mineral industry and its role in national economy; world and national mineral resources; Mining - A unique investment environment; special risk factors in mine investment and evaluation; national mineral policy.

**UNIT II ORE RESERVE ESTIMATION**

**9**

Methods of sampling, sampling frequency; analysis of sampling data, estimation of reserves, introduction to geo-statistica I methods, classification of reserves.

**UNIT III MINE VALUATION****12**

Time value of money; annuity; redemption of capital, net present value; depletion allowance; depreciation; inflation; escalation; rates of return; Hoskold's Two rate method; capital and operating cost including wages, incentives, material, etc.; assets; liabilities; cash flows and discounted cash flow; profitability index – their implications in mine economic evaluation.

**UNIT IV PROJECT APPRAISAL****12**

Methods of project evaluation – pay back, annual value, benefit/cost ratio, ERR and IRR, etc., evaluation of exploratory mining areas and operating mines; mine project financing, its risks and constraints; mine taxation; critical impact of depreciation, depletion, type of funding, reserves, life, etc., on mine profitability.

**UNIT V FINANCE AND ACCOUNTING****8**

Sources of mine funds – shares, debentures, fixed deposit, sinking fund, capital gearing, P & L account, balance sheet, typical case studies of mine feasibility. Cost estimation of individual mining operations and overall mining cost, cost control methods.

**TOTAL: 45 PERIODS****REFERENCES**

1. Sloan, D.A., Mine Management, Chapman and Hall, London, 1983.
2. Deshmukh, R.T., Mineral and Mine Economics, Mira Publications, Nagpur, 1986.
3. Arogyaswamy, R.N.P. Courses in Mining Geology, Oxford and IBH Publishing Co., 1994.
4. Chatterjee, K.K., Mineral economics, Wiley Eastern, 1992.
5. Park, R.J., Examination and Valuation of mineral property
6. How to read a balance sheet ILO 1992.
7. Indian Mining Year Book 1994 – MMRD Act and Mineral Concession Rules.

**MI8702****MINE ENVIRONMENTAL ENGINEERING – III****L T P C****3 0 0 3****UNIT I SPONTANEOUS HEATING AND FIRES****12**

Causes, detection, incubation period, precautions against spontaneous heating in underground and surface coalmines including coal benches, surface coal stocks, and dumps. Detection, prevention and control of underground fires, fire fighting, study of atmosphere behind sealed-off fire areas for reopening, methods of reopening sealed off fire areas.

**UNIT II EXPLOSIONS****12**

Causes, prevention and control of underground fire-damp and coal dust explosions including stone dusting, stone dust barriers, water barriers and triggered barriers, investigation after an explosion.

**UNIT III MINE RESCUE AND FIRST AID****9**

Classification of rescue apparatus including self rescuer, various types of rescue and escape apparatus, rescue organisation of a mining company, layout of a modern rescue station including personnel, first aid to the persons injured in mine-accidents, electric shock, asphyxiation, different methods of artificial respiration, rescue and recovery work in mines including through boreholes, rescue rules.

**UNIT IV INUNDATION****9**

Surface and underground inundation, their causes and preventive measures, precautions to be taken while approaching old waterlogged workings, safety boring apparatus, design and construction of water dams and barriers, recovery of flooded mines, dewatering of old workings, layout of drainage systems and sumps.

**UNIT-V MINE ILLUMINATION****6**

Electric safety lamps, their maintenance and examination, lamp room design and organisation, lighting from mains, lighting on mechanised longwall faces and gassy mines, photometry and illumination survey, legislations related to illumination survey.

Note: All the above are to be studied with emphasis on CMR and the relevant circulars

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Ramlu, M.A., Mines Fires, Explosion, Rescue, Recovery and Inundations, Mukhertu Publishers, Kharagpur, 1989.
2. Ramlu, M.A., Mine Disasters and Mine Rescue, Oxford and IBH Publishers, 1991.
3. McPherson, M.J., Subsurface Ventilation and Environmental Engineering, Chapman & Hall Publication, London, 1993.

**REFERENCES:**

1. Misra, G.B., Mine Environment and Ventilation, Oxford University Press, 1993.
2. The Mine Rescue Rules, 1986, Lovely Prakashan, Dhanbad, 1992.
3. Cummings A.B., and Given, I.V., SME Mining Engg. Hand Book Vol. I and II, New York, 1994.

4. Sarkar, S.K. and Sarkar, S., State of Environment and Development in Indian Coalfields, Oxford and IBH, 1996.
5. Classified Circulars by D.G.M.S., Dhanbad.
6. Ghatak, S., Mine Management, Legislation & General Safety.
7. Kaku, L.C. Fires in Coal Mines.

**MI 8703**

**MINE PLANNING AND DESIGN**

**L T P C  
3 0 0 3**

**UNIT I INTRODUCTION**

**7**

Technical factors in mine planning, methodology of mine planning, short range & long range, mine modelling, mine simulation systems approach to mine planning based on mine sub-system and their elements, mine plan generation

**UNIT II OPENCAST MINING**

**10**

Selection of initial mine cuts, location of surface structures, division of mining area into blocks, mine design, bench drainage, geometry, haul roads, slope stability; open pit limits and optimisation, calendar plan, production planning, production scheduling, economic productivity indices.

**UNIT III UNDERGROUND MINING**

**10**

Location of mine entries, mine and auxiliary, optimisation of mine parameters, design of shaft pillars and protective pillars, planning of production capacity, layout of development drives / raises / winzes etc, length of faces, size of panels, etc, planning of support systems, ventilation, lay out of drainage system, planning production schedule and monitoring, selection of depillaring / stoping method, manpower management economic/ productivity indices, techno-economic analysis, mine reclamation design.

**UNIT IV EQUIPMENT PLANNING**

**10**

Latest technological developments in increase in both types and capacities of equipment used in mining operations. Planning and selection of equipment for different mining conditions. Equipment design for optimum drilling and blasting operations. Equipment information – performance monitoring and expert systems, Innovative mining systems.

**UNIT V PROJECT IMPLEMENTATION AND MONITORING**

**8**

Pre-project activities – feasibility report, environment clearance, detailed project, report,



sources of funds, import of technology, selection of contracts and contract administration, time management, cost control material management system, project quality assurance, social responsibility, government orders and guidelines. Environmental impact assessment and preparation of environmental management plan. Mine closure plan.

**TOTAL : 45 PERIODS**

## **REFERENCES**

1. Jayanth Bhattacharya, Principles of Mine Planning-Allied Publishers, Delhi 2003.
2. Hustrulid, W. and Kuchta, M., (eds)., Fundamentals of Open pit Mine Planning and Design, Elsevier, 1995.
3. Ehrenburger, V and Fajkos, A., Mining Modelling, Elsevier, 1995.
4. Bawden, W.F., and Archibald., J.F., Innovative Mine Design for the 21st Century Elsevier, 1993.
5. Passamehtoglu, A.G., Karpuz, C., Eskikaya, S. and Hizal, T., (Eds), Mine Planning and Equipment Selection, Elsevier, 1994.
6. Pazdziora, J., Design of Underground Hard Coal Mines, Elsevier, 1988.
7. Swilski, and Richards, Underground Hard Coal Mines, Elsevier, 1986.
8. Singh, B. and Pal Roy, P., Blasting in Underground excavations and mines, CMRS Dhanbad, 1993.
9. Raj, K Singhal (Ed.), Mine Planning & Equipment Selection, A.A., Balkema, 1988.
10. Peng, S.S. and Chaing, H.S., Longwall Mining, John Wiley & Sons, New York, 1984.
11. Rzhovsky, V.V., Opencast Mining – Technology and Integrated Mechanisation, MIR Publishers, Moscow, 1987.
12. Rzhovsky, V.V., Opencast Mining – Unit Operations, MIR Publishers, Moscow, 1987.

**MI 8711**

**COMPREHENSION**

**L T P C**

**0 0 2 1**

### **AIM:**

To sharpen the knowledge and clarify the ideas acquired by the students during the degree programme

The objective of this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including materials, manufacturing process, product and process control, computer integrated manufacture and quality. The students work in groups and solve a variety of problems given to them. The problems given to the students should

be of real like industrial problems selected by a group of faculty members of the concerned department. A minimum of three small problems have to be solved by each group of students. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.

**MI 8712**

**COMPUTER APPLICATIONS IN MINING LABORATORY**

**L T P C**

**0042**

**AIM:**

To develop algorithms and programs on various mining related problems in basic programming languages.

1. Computer programming for mining problems like design of pillars / blast design / subsidence prediction.
2. Mine ventilation network analysis.
3. Database systems and analysis
4. Digitisation and scanning of mine plans
5. Ore body modeling.
6. Pit optimization.
7. Truck dispatch system optimization.
8. Production Scheduling for grade control
9. Digital Terrain modeling and Wire-frame modeling
10. Mine modeling
11. Slope stability analysis
12. Modelling of airflow through underground workings using finite element method.

**TOTAL: 60 PERIODS**

**MI8713**

**MINE ENVIRONMENTAL ENGINEERING LABORATORY**

**L T P C**

**0021**

**AIM:**

To demonstrate the various methods and instrumentation involved in analysing an underground mine atmosphere.

**OBJECTIVE:**

1. To determine the psychrometric properties, gas percentage in atmosphere.
2. To study the principles and characteristics governing mine fans.
3. To understand lamp design and perform underground illumination surveys.
1. Study of mine flame safety lamp, gas testing with flame safety lamp, electric cap lamps, lamp room layouts and illumination survey.
2. Mine air sampling and detection of various mine gasses, like, methane, carbon monoxide (CO), by conventional methods and by gas chromatograph, etc.
3. Determination of psychrometric properties of air, measurement of cooling power by Kata thermometer.
4. Study of air-reversal arrangement in mine fans.
5. Study of pressure survey and quantity survey in mines using velometer, anemometer and barometer.
6. Determination of air born dust by gravimetric dust sampler, personal dust sampler and by high volume sampler.
7. Noise survey.
8. Determination of crossing point temperature and index of inflammability.
9. Study of self rescuers of different types.
10. Study of self contained breathing apparatus
11. Proximate analysis of coal
12. Measurement of vibrations due to various sources.
13. Determination of pH, TDS, TSS, dissolved oxygen and chemical oxygen demand of water.
14. Determination of organic carbon of soil sample

**MI 8715****PRACTICAL TRAINING - III****L T P C****0 0 0 1****AIM:**

To provide training in mines for gaining thorough understanding of all the theoretical knowledge.

Gaining practical experience is an important aspect of the mining engineering programme having many characteristic features of its own.

The students have to undergo training in mines during the summer vacation at the end of the VI Semester for a period of 4 weeks and obtain a valid certificate from the competent authority

of the organisation provide training. The students have to submit a report on the training which would be evaluated during the ensuing VII Semester. This carries a total of one credit during the VII Semester. Evaluation would be done by a faculty or a group of faculties on different marking heads such as training, viva voce report etc., or other approved evaluation systems.

Normally a student is not permitted to withdraw from the practical training. In case of any unforeseen circumstances / valid reasons if he could not undergo the training as scheduled, on the recommendation of the Head of the Department and approval by the competent authority the student may be permitted to undergo Practical Training-III before proceeding to VIII Semester. The decision of the competent authority is final.

**MI8716    ROCK MECHANICS AND GROUND CONTROL LABORATORY – II    L T P C**  
**0 0 2 1**

**AIM:**

To give hands-on skills to the students in determining the physic-mechanical properties of rock; providing insight into the geotechnical parameters governing the strength of rocks.

1. Time dependent properties of rocks
2. Drillability index of rocks.
3. Stress and fracture patterns around underground model openings
4. Design of mine pillars.
5. Prediction of Subsidence.
6. Young's Modulus of Elasticity and Poisson's ratio.
7. Rock anchorage capacity of a rock bolt
8. Roof convergence and other ground control instruments
9. Post Failure Behaviour of Rocks
10. Angle of Internal Friction
11. Ground Vibration Monitoring
12. Stowing Characteristics
13. Permeability

**TOTAL : 30 PERIODS**

**MI 8717**

**SURVEY CAMP**

**L T P C**

**0 0 0 1**

The course of mine surveying is sharply demarcated into general principles and practice of surveying and surveying practice in mines. The subject of Surveying is applied in nature and is best learnt in an operating mine. This is done during the mine survey camp organised in an underground mine as part of the curriculum.

The students of VI Semester have to undergo the survey camp during the semester for a period of 10 days and submit a report. This carries one credit.

If due to valid reasons a student could not undergo this survey camp as scheduled he could do so along with the succeeding batch with the recommendation of the Head of the Department and approval by the competent authority, whose decision is final in this regard.

**MI 8714**

**MINI PROJECT**

**L T P C**

**0 0 4 2**

Students have to undertake a Mini Project work. The aim of the project is to stimulate creative and innovative aspects of their technological learning. The project may consist of design and fabrication, working models, demonstration models, software development, field study in the Mines, Industrial plants, application of software development of feasibility and detail project report of mines environmental project etc. The students have to carry out the projects consisting of a group of students by forming a team of students whose two to three students and have to carry out work for full semester. The students should submit a report and compassing their design results etc.

**TOTAL : 60 PERIODS**

**MI 8801**

**MINE LEGISLATION AND SAFETY**

**L T P C**

**3 0 0 3**

**UNIT I INTRODUCTION TO MINING LAWS AND LEGISLATION**

**2**

General principles of mining laws, development of mining legislation of India.

**UNIT II ACTS, RULES AND REGULATIONS – I**

**15**

Mines Act, Mines Rules, Coal and metalliferous mines Regulations, Bye-laws, Circulars, and standing orders (Except the ones which are collected in course Drilling & Blasting, Surface

Mining, Mining Machinery I & II, Mine Environmental Engineering I, II & III, Underground Mining methods (Coal & Metal))

**UNIT III ACTS RULES AND REGULATIONS – II 15**

Indian electricity rules, coalmines conservation and development act, Workman's compensation act., General provisions of Mines and Minerals Regulation and Development Act, Mineral Concession Rules, Vocational Training .Rules, Crèche rules, Maternity benefit act, Payment of Wages Act, Gratuity and P.F. Rules, Explosives act, Rescue Rules, Factory Act, Environmental Protection Act.

**UNIT IV ACCIDENTS AND DISEASES 8**

Classification of accidents, causes and prevention of accidents, accident enquiry reports, cost of accidents, occupational diseases and their social effects.

**UNIT V MINE SAFETY 5**

Role of management, labour and government, Safety audit, instrumentation, organisation for disaster management in mines, safety conferences.

**TOTAL : 45 PERIODS**

**REFERENCES**

1. Mines Act 1952, Lovely Prakashan, Dhanbad, 1995.
2. Coal Mines Regulations, 1961, Lovely Prakashan, Dhanbad, 1995.
3. Metal Mines Regulations, 1961, Lovely Prakashan, Dhanbad, 1995.
4. DGMS Circulars, By National Council of Safety in Mines, Dhanbad, 1995.
5. Mines rules, 1955, Lovely Prakashan, Dhanbad, 1995.
6. The Mines Rescue Rules, 1986, Lovely Prakashan, Dhanbad, 1995.
7. The Indian Electricity Rules, 1995, Lovely Prakashan, Dhanbad, 1995.
8. The Payment of Wages Act, 1936, Ram Narain Lal Beni Prasad, 1995.
9. Vocational Training Rules, Lovely Prakashan, Dhanbad, 1995.
10. The Workmen's compensation Act, 1923, Ram Narainlal Beni Prasad, Allahabad, 1995.
11. Kejriwal, B.K., Safety in Mines, Gyan Khan Prakashan, Dhanbad, 1994.

**AIM:**

To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems and suggest solution.

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

**MI 8001****ADVANCED COAL MINING AND MECHANIZATION****L T P C****3 0 0 3****UNIT I COAL FACE MECHANISATION****8**

Recent Trends, mechanised bord and pillar mining, case studies.

**UNIT II MINING OF THICK SEAMS****8**

Problems, past experiences in India, current methods, mining of thick, contiguous, and steep seams

**UNIT III HYDRAULIC MINING****9**

Applicability, operating parameters, equipment, layouts, Indian experience. Computer applications such as remote control and environmental monitoring in hydraulic mining.

**UNIT IV LONGWALL MINING****10**

Powered supports, development of powered supports, their types and designs, selection for different conditions, last drivages for longwall panelling, remotely operated powered support and longwall faces, Indian experiments, salvaging in longwall.

## **UNIT V UNDERGROUND COAL GASSIFICATION**

**10**

Scope, application, methods of gasification, design of gasification plants, coal bed methane. Environmental monitoring techniques and computer applications in coal gasification techniques.

### **REFERENCES:**

1. Das S.K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1994
2. Singh, T.N., and Dhar, B.B. Thick Seam Mining, Problems and Issues, Oxford & IBH Publishers, 1992
3. Mathur, S.P., Mining Planning for Coal, M G Consultants, Bilaspur, 1993
4. Peng S.S. and Chiang, H.S., Longwall Mining, John Willey and Sons, New York, 1992
5. T.N. Singh, Underground Winning of Coal, Oxford IBH Publishers, 1999
6. R.D. Singh, Principles and Practices of Modern Coal Mining, New Age International, 1997

**MI 8002**

## **ADVANCED METAL MINING AND MECHANIZATION**

**L T P C**

**3 0 0 3**

### **UNIT I ADVANCED MINE DEVELOPMENT**

**9**

Recent advances in raising, winzings, development of drives, tunnels, cross-cuts, drifts, stope preparations, opening up of mineral deposit, enlargement of drives and raises, recent trends in shaft sinking. Techno economic aspects.

### **UNIT II ADVANCED METAL MINING AND STOPING PRACTICES**

**9**

Recent advances in stoping practices, VCR mining, deep mining, stoping practices in rock burst prone mines, back-filling, recent developments in metal mining in India.

### **UNIT III MECHANISATION, SUPPORT SYSTEMS IN METAL MINES**

**9**

Mechanisation in metal mines – LHD declines, hydraulic transport, trackless mining, modern support system used in metal mines, recent developments in winding and transport

### **UNIT IV SPECIAL MINING TECHNIQUES**

**9**

Marine mining methods – sea water, marine beaches, continental shelves, sea-bed sediments and polymetallic nodules, solution mining, ore leaching, in situ leaching techniques.



**UNIT V SPECIAL PROBLEMS OF ORE MINING****9**

Special problems of deep mines – rock pressure, heat, humidity, rock burst, noise and dust pollution, deep winding and transport, etc.

**TOTAL: 45 PERIODS****REFERENCES;**

1. Cummings, A.B. and Given, I.V., SME Mining Engg. Vol.I and II, Society of Mining Engineers of American Institute of Mining, Metallurgical Petroleum Engineers, Inc., New York, 1994
2. Hartman, H.L., Mine Ventilation and Air Conditioning, Wiley Inter Science Publication, New York, 1986
3. Peng, S.S, Ground Control, Wiley Interscience, New York, 1985
4. Underground Mining Methods Handbook, AMIE Publication, 1992
5. Karmakar, H., Mine Working, Vol. I and II, Lovely Prakashan, Dhanbad, 1995
6. Underground Mining Methods and Technology, Elsevier Science Publishers, 1990

**MI 8003****ADVANCED SURFACE MINING****L T P C****3 0 0 3****UNIT I PLANNING****10**

Open-pit optimisation techniques for mine geometry and output, mine development phases, quality control and conservation. Output and manpower planning; calendar planning, mine scheduling, production scheduling, truck dispatch system, design of sumps and pumping systems and drainage.

**UNIT II GEOTECHNICAL PARAMETERS****7**

Application of geotechnical investigation for design of ultimate pit slope and other design parameter, slope stability analysis including mine waste rock dumps and tailing dumps.

**UNIT III EQUIPMENT MANAGEMENT****7**

Machine availability, productivity, maintenance, maintenance scheduling, preventive maintenance, control and monitoring inventory. Workshops for HEMM. Power supply arrangements in opencast mines.

**UNIT IV SAFETY AND ENVIRONMENT****10**

Safety aspects in opencast mines regarding height, width and slope of benches, drilling and blasting, fly rock, nearby dwellings, mine illumination, gradient and other aspects of haul roads, formation of spoil dumps, tailings management etc. pollution due to noise, vibrations due to machinery and blasting, water pollution, measurement monitoring and control measures for the same, land reclamation and afforestation, environmental audit.

**UNIT V MODERN TRENDS IN OPENCAST MINES****11**

Recent developments in mining methods and layouts. In pit crushing & conveying, continuous surface mining. Selective extraction and dumping. Extraction of seams developed/extracted by underground methods. Deep OCM.Placer mining and solution mining – scope of applicability, sequence of development and machinery

**TOTAL :45 PERIODS****REFERENCES**

1. Cummings, A.B. and Given, I.V., SME Mining Engg. Hand book Vol.I and II, New York, 1994
2. Proceedings of National Seminar on Surface Mining, IME Publications/ Calcutta, 1995
3. Das, S.K., Surface Mining Technology, Lovely Prakashan, Dhanbad, 1994
4. Das, S.K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1994
5. Kennedy, B.A., Surface Mining – 2nd Edition, SME, New York, 1990
6. Hustrulid, W. and Kuchta, M., (eds)., Fundamentals of Open Pit Mine Planning & Design, Elsevier, 1995

**MI8004****ENERGY CONSERVATION AND MANAGEMENT****L T P C****3 0 0 3****UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT****8**

World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing : methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

**UNIT II ELECTRICAL SYSTEMS****12**

AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting :

lighting levels, efficient options, daylighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.

**UNIT III THERMAL SYSTEMS 10**

Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach.

**UNIT IV ENERGY CONSERVATION 8**

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

**UNIT V ENERGY MANAGEMENT, ECONOMICS 7**

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.

**TOTAL: 45 PERIODS**

**TEXT BOOK**

1. L.C. Witte, P.S. Schmidt, D.R. Brown, Industrial Energy Management and Utilisation, Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.

**REFERENCES**

1. IDryden, I.G.C. The Efficient Use of Energy, Butterworths, London, 1982
2. Turner, W.C. Energy Management Hand Book, Wiley, New York, 1982.
3. Murphy, W.R. and Mc KAY, G. Energy Management, Butterworths, London 1987.

**MI 8005**

**LONGWALL MINING**

**L T P C**

**3 0 0 3**

**UNIT I PLANNING 10**

History of longwall mining and its development, techno-economic consideration of the modified longwall retreat panels, longwall advance panels with caving method and stowing



## REFERENCES:

1. Mathur, S.P., Mining Planning for Coal, M.G. Consultants, Bilaspur, 1999
2. Singh T.N., Dhar, B.B. Thick Seam Mining, problems and Issues, Oxford & IBH Publishers, 1992.
3. Das S.K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1994.
4. Longwall Mining in Company Seminar – Proceedings – The Singareni Collieries Co. Ltd., 1990.

**MI 8006**

**MATERIAL HANDLING**

**L T P C**

**3 0 0 3**

### **UNIT I BULK HANDLING SYSTEMS**

**9**

Basic principles in material handling exclusive to mining industry and its benefits. Classification of material handling equipments. Current state of art of bulk handling materials in mining in the world and Indian scenario; Selection of suitable types of systems for application. Stacking, blending, reclaiming and wagon loading, machinery and systems used at the stack yards; stock piles, silos, bunkers – their design, reclamation from them, various types of weigh bridges. Segregation - size wise and grade wise, Railway sidings.

### **UNIT II SHORT CONVEYORS AND HAULAGE SYSTEMS**

**9**

Roller conveyor, overhead conveyor, screw conveyor, auger conveyor, apron feeder, bucket elevators, scraper haulage, conveyors in steep gradient, Armoured face conveyor, Off-highway Trucks, haul roads, In-pit crushers and modular conveyors, electric trolley assisted haulage, shuttle cars, skip hoist, winders, LHD's, pneumatic conveying, hydraulic transport.

### **UNIT III BELT CONVEYOR SYSTEM**

**9**

Design, capacity, calculations with respect to the size, speed, troughing, power requirement, tension requirement, belt selection, factor of safety; developments in the design, of various components of belt conveyor systems such as; structures, rollers, gear boxes and motors, drums and pulleys, belting, ancillary components and safety gadgets.

### **UNIT IV NEW TYPES OF BELT CONVEYOR SYSTEMS**

**9**

Curved conveyors, cable belts, pipe conveyors, rock belts – mine-run-rock conveyor, steel belt conveyors, steel slot conveyor, chain belt conveyors, etc., and other new developments, stackers and reclaimers, High Angle Conveyors (HAC); New inventions in HAC , Mobile or fixed installations; Woven wire belts, En Masse conveyor, Vibrating conveyor, gravity bucket conveyor.

**UNIT V MATERIAL HANDLING IN MINES, PLANTS AND WORKSHOPS 9**

Mobile cranes, derrick cranes, pillar cranes, tower cranes, radial cranes, bridge cranes, fork lifters, over head gantry material handling in workshops. Mineral handling in dimensional stone quarries, Mineral handling plants(coal, etc., )

Locomotives, rail tracks, rail cars, railways wagons; Aerial ropeways, gravity ropeways; Containers and shipping; Rope haulage - different types.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Allegri (Sr.), T.H., Material Handling – Principles and Practices, CBS Publishers and Distributors, Delhi, 1987.
2. Hustrulid, W., and Kuchta, M. Open Pit Mine Planning & Design, Vol. 1, Fundamentals, Balkema, Rotterdam, 1998.
3. Peng, S.S., and Chiang, H.S., Longwall Mining, John Wiley and Sons, New York, 1984.
4. Hartman, H.L., (Ed.), SME Mining Engg. Handbook Vol.I and II, Society for Mining, Metallurgy, and Exploration, Inc., Colorado, 1992.

**REFERENCES:**

1. Kennedy, B.A., Surface Mining – 2nd Edition, SME, New York, 1990.
2. Deshmukh, D.J., Elements of Mining Technology, Vol.I, II and III, EMDEE Publishers, Nagpur, 1979.
3. Vorobjev, B.M., and Deshmukh, R.T. Advanced coal Mining, Vol.I and II, Mrs Kusum Deshmukh, P.O. Indian School of Mines, 1966.
4. Woodruff, S.D., Methods of Mining, Working, Coal and Metal Mines, Vol.II and III, Pergamon Press, 1968.
5. Sinclair, J., Winding and Transport in Mines, Sir Isaac Pitman and Sons, Ltd., London, 1959.

**MI 8007**

**MATERIAL MANAGEMENT**

**L T P C**

**3 0 0 3**

**UNIT I INTRODUCTION 8**

Introduction to material management, importance of integrated materials management, need for integrated materials management concept, definition, scope and advantage - an overview, A-B-C analysis, codification, variety reduction, standardisation.

**UNIT II PURCHASING MANAGEMENT 10**

Material planning and purchase, purchase system, procedures, price forecasting, purchasing of capital equipment, vendor development, account procedure, purchasing decisions, procurement policies.

**UNIT III WARE HOUSING AND STORE MANAGEMENT 10**

Store keeping principles – past and latest techniques, stores-general layout, cost aspect and productivity, problems and development, store system procedures incoming material control, store accounting and stock incoming material control, store accounting and stock verification, value analysis

**UNIT IV INVENTORY MANAGEMENT 10**

Introduction, basic models, definition of commonly used terms, replenishment model, choice of systems, etc. inventory work in progress, safety stock, computerisation in materials management control, information to materials management case study, spare parts management.

**UNIT V MATERIAL PROCUREMENT PROCEDURES 7**

Arbitration Act – Octroi, central and local sales tax, excise duties – customs tariff, import control policies, procurement from govt. agencies and international market – insurance, DGS and D tariff.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Gopalakrishnan, P., and Sundaresan, M. Material Management, An Integrated Approach, Prentice Hall of India Pvt. Ltd., New Delhi, 1982.
2. Datta, A.K., Materials Management Procedure, Test and cases, Prentice Hall of India Pvt Ltd., New Delhi, 1984.
3. Peckam, H.H., Effective Materials Management, Prentice Hall of India Pvt Ltd., 1984.
4. Prichard, J.W., and Eagle, R.H. Modern Inventory Management, N.Y., Wiley and Breach Science Publishers, 1972.

**UNIT I MINE ACCIDENTS 8**

Accident in mines;- different types, accident investigations; accident analysis; accident prevention and corrective action, accident proneness, creating and maintaining safety awareness, ZAP and MAP, job safety analysis, safety meeting and committee.

**UNIT II HEALTH AND MINE SAFETY 8**

Definition of health and safety, management's role – function; evolution of management involvement, management's training, responsibility, cost of health and safety, role of labour organizations – Union impact and involvement, role of government – statutory controls and directions, spot and regular inspections, enforcement of standards, penalties for violations, collection and distribution of statistical data.

**UNIT III FAULT TREE ANALYSIS 8**

Introduction – methodology, symbols and Boolean techniques, qualitative analysis, computerized methods, statistical analysis, safety information, systems design.

**UNIT IV RISK ASSESSEMENT AND DISASTER MANAGEMENT 11**

Principles, risk and hazard control, risk and hazard evaluation and data collection for identified health risks, exposure assessment and risk characterization, probabilistic risk analysis, risk management, safety culture, human factors, reliability evaluation, safety audit. Identification of causes of mine disasters, preventive action, disaster management and mitigation, typical cases of mine disasters in India

**UNIT V MINER'S OCCUPATIONAL DISEASES AND ENQUIRY COMMITTEE 10**

Miner's occupational health and diseases, preventive medical examinations, various types of injuries, compensable diseases, medical attention and removable of causative factors in the mines. Recommendations of inquiry committee carried out for safety and health issues in India.

**TOTAL :45 PERIODS****REFERENCES**

1. Brown, D.B., System Analysis and Design for Safety, Prentice Hall, 1976.
2. Stranks, J., Management Systems for Safety, Pitman Publishing, 1994.



3. DeReamer, R., Modern Safety Practices, John Wiley and Sons.
4. Wahab Khair. A., New Technology in Health and Safety, SMME, 1992.
5. Zyl, D.A., Koval, M, Li Ta, M. (Ed.). Risk Assessment / Management Issues in the Environmental Planning in Mines, SMME, 1992.
6. Prasad, S.D. and Rakesh., A Critical Appraisal of Mine Legislations. Lovely Prakashan, 1995. Dhanbad.
7. Mine Disasters of India, NCSM Publication.
8. Kejriwal, B.K., Safety in Mines, Gyan Khan Prakashan, Dhanbad, 1994.

**MI8009**

**MINERAL EXPLORATION**

**L T P C**

**3 0 0 3**

**UNIT I**

**MINERAL RESOURCES AND PROSPECTING**

**10**

Introduction to important mineral resources in India and world wide, surface and aerial prospecting, reconnaissance, application of geochemical, geophysical and geostatistical methods

**UNIT II**

**EXPLORATION**

**9**

Preliminary and detailed exploration by boring, exploratory mining by shafts, drifts, cross-cuts, collection and compilation of data for computer processing.

**UNIT III**

**EXPLORATION STRATEGY**

**8**

Exploration investment decision, exploration techniques and strategies, exploration targets.

**UNIT IV**

**EXPLORATION GROUPS AND THEIR ROLE**

**8**

Strategy and structure of the exploration group, government policies, aspects of exploration, role of exploration in the mining company.

**UNIT V**

**PREPARATION AND EVALUATION OF PROJECT REPORTS**

**10**

Evaluation of exploration and development projects, study of typical pre-feasibility and feasibility reports.

**TOTAL : 45 PERIODS**

**REFERENCES**

1. Deshmukh, R.T., Mineral and Mine Economics, Mira Publications, Nagpur, 1986.
2. Cummings, A.B. and Given, I.V., SME Mining Engg. Handbook, Vol. I and II, Society of

Mining Engineers of American Institute of Mining, Metallurgical, Petroleum Engineers INC, New York, 1992.

3. Sloan, D.A., Mine Management, Chapman and Hall, London, 1983.
4. Arogyaswamy, R.N.P., Courses in Mining Geology, Oxford and IBH Publishing Company Private Limited, 1994.
5. Bhattacharjee, S., Frontiers in Exploration Geophysics Oxford and IBH Publishing Company, 1992.
6. A.K. Ghosh., Strategies for Exploitation of Mineral Resources in developing countries, Oxford & IBH Publishing Company, 1992.
7. Kuzvart, M. and Bohmer, M., Prospecting and Exploration of Mineral Deposits, Elsevier Science Publishers, 1993.

**MI8010**

**NON-DESTRUCTIVE TESTING**

**L T P C**

**3 0 0 3**

**UNIT I LIQUID PENETRANT AND MAGNETIC PARTICLE INSPECTION 9**

Liquid penetrant systems - processing cycles - inspection of surface defects - Generation of Magnetic fields - Magnetic particle inspection equipments - Demagnetization - Applications and limitations.

**UNIT II RADIOGRAPHY 11**

Production of x-rays - Characteristic rays and white ray - Tube current and Voltage - Sources of 8 rays - Half life period - Penetrating power - Absorption of x and y rays - Radiation contrast and film contrast - exposure charts - pentameters and sensitivity - Safety.

**UNIT III EDDY CURRENT INSPECTION 7**

Eddy current production - Impedance concepts - inspection of magnetic materials - inspection of non magnetic materials - influences of various parameters - Advantages and limitations.

**UNIT IV ULTRASONIC TESTING 10**

Production of ultrasonic waves - Different types of waves - Normal beam inspection - Angle beam inspection - thickness measurements - Applications.

**UNIT V RECENT TECHNIQUES 8**

Principles of acoustic emission - instrumentation for non destructive testing - Principles of holography - Applications of holographic techniques non destructive inspection - advantages and limitations - Other techniques.



## REFERENCES

1. Desai, C.S. and Abel, J.F., Introduction to the finite Element Method, Van Nostrand Rieholkl Co., New York, 1983.
2. Zienkiewicz, O.C., The Finite Element Method in Engineering Science, Tata McGraw Hill 1972.
3. Segerlind, L.J., Applied Finite Element Analysis, John Wiley and Sons, New York, 1987.
4. Mukhopadyay, M., Matrix Finite Element – Computer and Structural Analysis, Oxford and IBH Publishing co., 1984
5. Brown, E.T., (Ed) Analytical and Computational Methods in Engineering and Rock Mechanics, Allen and Unwin, London, 1987.

**MI8012**

**OBJECT ORIENTED PROGRAMMING**

**L T P C**  
**3 0 0 3**

### **UNIT I INTRODUCTION**

**9**

Programming methodologies – comparison – features of object oriented programming – basics of java environment.

#### **Classes**

Definition – fields – methods – access specifiers – object creation – construction overloading – methods – static members this keyword – nested classes.

### **UNIT II EXTENDING CLASSES**

**9**

Inheritance – constructors – member accessibility – overriding methods – abstract classes – interfaces – flow control – exceptions.

### **UNIT III THREADS AND PACKAGES**

**9**

Threads – creation – synchronization – scheduling – ending – packages – I/O package streams – byte – character – buffered – filter – pipe.

### **UNIT IV EVENT HANDLING AND NETWORKING**

**9**

Applets development execution – passing params GUI objects – programming – event handling – network – ping – socket programming – standard utilities – standard packages.

### **UNIT V C++**

**9**

Differences between Java and C++ - multiple inheritance – pointers – templates.

**TOTAL: 45 PERIODS**



settings depth selection, casing design, specialization of casing, collapses pressure, tensile load, burst pressure, tension on collapse strength of casing, design factors, casing design, cementation, cement properties, types procedures and purposes.

**UNIT V WELL COMPLETION AND PRODUCTION 9**

Logging operations, logging methods, interpretation calculation of saturation, gas saturation, water saturation, porosity, permeability, oil and gas findings, perforation techniques, well completion, production tubing, well head x'mas tree fittings – transportation - oil to gas and water separator – oil to stockyard Reservoir Engineering – concept and approach, oil recovery – primary, secondary, enhanced oil recovery techniques. Offshore drilling technology, rigs of offshore drilling, general jacking procedures, drilling from a floating vessel. International oil business, management and economics.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Whittaker, A., Theory and Application of Drilling Fluid Hydraulics, International Human Resources Development Corporation, Boston, 1985.
2. Rebig, H., Oil Well Drilling Engineering: Principles & Practices, Graham & Trotman, London, 1988.
3. Gatlin, C., Petroleum Engineering: Drilling and Well Completion, Prentice Hall, Inc., USA., 1980.
4. Archer, J.S., and Wall, C.G. Petroleum Engineering, Graham & Trotman, London, 1988.
5. Bhagwan Sahay., Petroleum Exploration and Exploration Practices, Allied Publishers Ltd., 2003.
6. Frank John, Mark Cook and Mark Gratan. Hydro Carbon exploration and Production, Elsevier, 2003.
7. Australian Drilling Industry Training Committee Ltd., Drilling: The Manual of Methods, Application and Management, Lewis Publishers, 1997.

**MI 8014 ROCK EXCAVATION ENGINEERING L T P C  
3 0 0 3**

**UNIT I INTRODUCTION 9**

Concepts, historical developments in rock excavation, systems, factors affecting the rock fragmentation, mechanism of rock breakage and fracture; their application to rock fragmentation methods for rock fragmentation – explosive action, cutting, ripping and impacts.







**UNIT II      GEOLOGICAL AND STRENGTH PROPERTIES****12**

Geological parameters affecting slope stability; graphical representation of geological data; plotting and analysis of field measurements; physico-mechanical properties affecting slope stability, shearing on incline plane, determination of shear strength of rock and rock discontinuities; Ground water flow in rock masses; field measurement of permeability; measurement of water pressure.

**UNIT III      PLANE FAILURE****6**

Plane failure analysis; graphical analysis of stability; influence of ground water on stability; influence of tension crack; rock reinforcement; analysis of failure on a rough plane; case studies.

**UNIT IV      WEDGE FAILURE****5**

Analysis of wedge failure; wedge analysis including cohesion and water pressure; case studies.

**UNIT V      CIRCULAR AND TOPPLING FAILURE****14**

Conditions for circular failure; derivation of circular failure analysis; effect of ground water; circular failure charts; Bishop's and Janbu's methods of failure analysis; case studies. Types of toppling failure; secondary toppling; analysis of toppling failure; limit equilibrium analysis of toppling failures; Influence of slope curvature on stability; slope depressurisation; protection of slopes; control of rock falls; measurement and monitoring and interpretation of slope displacements.

**TOTAL :45 PERIODS****REFERENCES**

1. Hoek, E and Bray, J.W., Rock Slope Engineering, Institution of Mining and Metallurgy, 1991.
2. Goodman, R.E., Rock Mechanics, John Wiley and Sons, 1989.
3. Singh, R.N. and Ghose, A.K., Engineered Rock Structures in Mining and Civil Construction, A.A. Balkema, Netherlands, 2006.

**UNIT I INTRODUCTION TO SMALL SCALE MINING 9**

Concept of small scale mining, small scale mines – world wide, Indian Policy in small scale mines – practices, policies and perspectives, problems of small scale mines – finance, legislative support, technical expertise, environmental obligations, safety, health and training, environmental impacts and protection.

**UNIT II SMALL SCALE MINING METHODS 9**

Classification and mode of occurrence of granite and other minor minerals, physical, mechanical and chemical properties, geological aspects of mining, granite and dimensional stone mining – manual, semi-mechanised and mechanised mining methods, conventional & novel techniques, recent trends, processing, finishing, quality control, marketing & export of minerals. Case studies of mining of other minerals like sandstone, marble, beach sands, alluvial mining, mica, barytes, diamond and gemstones, etc.

**UNIT III INTRODUCTION TO MARINE MINING 9**

Introduction to marine environment, development & status of ocean resources of mining in India and other parts of the world, Ocean profile, ocean floor topography, economic exclusive zone & fundamentals of law of the sea, coastal zone & its characteristics.

**UNIT IV MARINE GEOLOGY AND RESOURCES 9**

Physical and chemical properties of seawater, overview of marine mineral deposits, deep-sea bed mineral resources, polymetallic nodules, sulphate nodules, chemicals from the ocean, dissolved and undissolved mineral deposits, sea water as resource and beach placers.

**UNIT V EXPLOITATION OF MARINE DEPOSTS 9**

Shallow and deep sea bed, oceanographic instruments, mining of manganese nodules, deep sea drilling methods, ocean bottom samplers, drag buckets, grab buckets, coring systems, ocean bathymetry, temperature measurement systems, water samplers, ocean dynamic analysis, beach placer mining, underwater photographs, vehicles and transportation, offshore oil platforms.

**TOTAL:45 PERIODS**

## REFERENCES

1. Chatterjee, S.K., An Introduction to Mineral Resources, Wiley Eastern Ltd., 1983.
2. Ghose, A.K., (Ed). Small Scale Mining – A Global Overview, Oxford - IBH Publishers, 1991
3. Shepherd, F.P., Sub-marine Geology, Harper and Row, New York, 1963.
4. Graff, W.J., Introduction to Offshore Structures: Design, Fabrication and Installation, Gulf Publishing Company, London, 1961.
5. Herbich, J.B., Coastal and Deep Ocean Dredging, Gulf Publishing Co. Houston, 1975.
6. Murthy, T.K.S., Mining the Ocean, CSIR Golden Jubilee Series, CSIR Publications, New Delhi, 1995.

**MI 8018**

**SUBSIDENCE ENGINEERING**

**L T P C**

**3 0 0 3**

### **UNIT I INTRODUCTION**

**9**

Strata movement at the mining horizon, convergence in mine working, factors influencing convergence in mine workings.

### **UNIT II SUBSIDENCE MECHANISM**

**9**

Zones of movement in the overlying beds, vertical and horizontal movement, subsidence trough, angle of draw, angle of break, sub-surface subsidence.

### **UNIT III SUBSIDENCE PREDICTION**

**9**

Different methods of surface subsidence prediction – graphical, analytical, profile function, empirical and theoretical models.

### **UNIT IV TIME INFLUENCE AND IMPACT ON STRUCTURES**

**9**

Influence of time on subsidence, example from longwall and bord and pillar workings. Calculation of ground movement over time. Types of stress on structures, stress-strain behaviour of soils, mining damage to buildings, industrial installations, railway lines, pipes, canals, etc.

### **UNIT V SUBSIDENCE CONTROL, GOVERNING LAWS AND STANDARDS**

**9**

Measures to reduce mining damage, mining methods to minimise damage, laws governing



**UNIT V MISCELLANEOUS****9**

Inventory of mineral resources, basic models and optimisation, introduction to statistical decision theory and its application in mineral industry.

**TOTAL : 45 PERIODS****REFERENCES**

1. Syal, I.C., and Gupta, B.P., Computer Programming and Engineering Analysis, A.B., Wheeler and Company, Madras 1986.
2. Anon., Management by Network Analysis, The Institution of Engineers (India), 1976.
3. Rao, S.S., Finite Element Methods in Engineering, Pergamon Press, 1982.
4. Cummings, A.B., and Given I.V. SME Mining Engg., Handbook Vol I and II, SME-41 ME, Inc, New York, 1973.
5. Zambo, J., and Kiado, A., Optimum Location of Mining facilities, Springer Verlag, Budapest, 1968.

**GE8071****FUNDAMENTALS OF NANOSCIENCES****L T P C****3 0 0 3****UNIT I INTRODUCTION****10**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II PREPARATION METHODS****10**

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES****5**

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

**UNIT IV PREPARATION ENVIRONMENTS 10**

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

**UNIT V CHARECTERISATION TECHNIQUES 10**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

**TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Edelstein, A.S. and Cammearata, R.C., eds. Nanomaterials: Synthesis, Properties and Applications, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo, N., Nanoscale. Characterization of Surfaces & Interfaces, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES**

1. G Timp, G. (Editor). Nanotechnology, AIP Press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor). The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**GE8751 ENGINEERING ETHICS AND HUMAN VALUES L T P C  
3 0 0 3**

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time– Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality.

**UNIT II ENGINEERING ETHICS 9**

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.



**UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 5**

General Principles of Management – Management Functions – Organization – Types – Comparison – Functions of Personnel Management – Recruitment – Training Leadership/ Motivation – Communication – Conflict Industrial Relations – Trade union.

**UNIT II INVENTOR MANAGEMENT 9**

Purpose of Inventory – Cost Related to inventors – Basic EOQ Model – Variations in EOQ Model – Finite Production – Quality Discounts – ABC Analysis – MRP Analysis – MRP – Lot size under constraints.

**UNIT III OPERATIONS MANAGEMENT 19**

Plant Location – Layout – Materials Handling – Method Study – Time Study Ergonomics – Aggregate Planning – Value Analysis – Statistical Quality Control – Quantitative techniques – Linear programming – sequencing – queuing theory – Network analysis.

**UNIT IV FINANCIAL MANAGEMENT 7**

Capital – Types – Sources – Break Even Analysis – Financial Statements – Income Statement – Balance Sheet – Capital Budgeting – Working Capital Management – Inventory Pricing.

**UNIT V MARKETING MANAGEMENT 5**

Functions of Marketing – Sales Promotion Methods – Advertising – Product Packaging – Marketing Variables – Distribution Channels – Organisation – Market research – Market Research Techniques.

**TOTAL : 45 PERIODS****TEXT BOOK**

1. Martand Telesang, Industrial and Business Management, S. Chand & Co., 2001.

**REFERENCES:**

1. Panneerselvam, K., Production and Operations Management-Prentice Hall of India, 2003.
2. Koont and O'donnel., Essentials of Management, Mc Graw Hill 1992.
3. Philips Kotler., Principles of Marketing, Prentice Hall of India, 1995.



4. Pandey, I.M., Financial Management, Vikas Publishing House, 1995.
5. Ahuja, K.K., Personal Management, Kalyane Publication, 1992.

## **MG8654 TOTAL QUALITY MANAGEMENT**

**L T P C**  
**3 0 0 3**

### **AIM**

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

### **OBJECTIVES**

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

### **UNIT I INTRODUCTION**

**9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

### **UNIT II TQM PRINCIPLES**

**9**

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

### **UNIT III TQM TOOLS & TECHNIQUES - I**

**9**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

### **UNIT IV TQM TOOLS & TECHNIQUES - II**

**9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function –TPM – Concepts, improvement needs – Performance measures - BPR.

## **UNIT V      QUALITY SYSTEMS**

**9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

**TOTAL : 45 PERIODS**

### **TEXT BOOK:**

1. Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint , 2006.

### **REFERENCE BOOKS:**

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S., “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition , 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”,Prentice Hall (India) Pvt. Ltd., 2006.

**ME8076**

**ENTREPRENEURSHIP DEVELOPMENT**

**L T P C**

**3 0 0 3**

### **OBJECTIVE:**

Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

## **UNIT I      ENTREPRENEURSHIP**

**9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

## **UNIT II      MOTIVATION**

**9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating,

Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS 9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING 9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS 9**

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

**REFERENCES:**

1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream Tech., 2nd Edition 2006.
3. Rabindra N. Kanungo, "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
4. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.

**OBJECTIVE:**

At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

**UNIT I INTRODUCTION 9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamilnadu, India and around the World - Potentials - Achievements / Applications – Economics of renewable energy systems.

**UNIT II SOLAR ENERGY 9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

**UNIT III WIND ENERGY 9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance - Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

**UNIT IV BIO - ENERGY 9**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications

**UNIT V OTHER RENEWABLE ENERGY SOURCES 9**

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

**TOTAL : 45 PERIODS****TEXT BOOKS:**

1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 2006.

## REFERENCES:

1. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
3. G.N. Tiwari, Solar Energy – Fundamentals Design, Modelling & Applications, Narosa Publishing House, New Delhi, 2002.
4. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, UK, 1990.
5. Johnson Gary, L., Wind Energy Systems, Prentice Hall, New York, 1985.
6. David M. Mousdale, Introduction to Biofuels, CRC Press, Taylor & Francis Group, USA 2010.
7. Chetan Singh Solanki, Solar Photovoltaics, Fundamentals, Technologies and Applications, PHI Learning Private Limited, New Delhi 2009.

**ME8752**

**FINITE ELEMENT ANALYSIS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

## UNIT I INTRODUCTION

**9**

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems – Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

## UNIT II ONE-DIMENSIONAL PROBLEMS

**9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.

## UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

**9**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –

Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements.

**UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

**UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS 9**

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. J.N.Reddy, “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2005.

**REFERENCE BOOKS:**

1. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
2. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.
4. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butter worth Heinemann, 2004
5. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall College Div, 1990.

**MF8078 QUALITY CONTROL AND RELIABILITY ENGINEERING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- Teach the essentiality of SQC, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques.

- Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

**UNIT I STATISTICAL QUALITY CONTROL 9**

Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes -Cumulative sum and Exponentially weighted moving average control charts - Other SPC Techniques – Process - Capability Analysis - Six sigma concept.

**UNIT II ACCEPTANCE SAMPLING 9**

Acceptance Sampling Problem - Single sampling plans for attributes – double sampling - multiple sampling - sequential sampling - Military standards - The Dodge Roming sampling plans – Random sampling.

**UNIT III RELIABILITY ENGINEERING 9**

Definition of reliability – Performance and reliability - Reliability requirements – System life cycle – Mean time between failures – Mean time to failure - Mortality Curve - Availability – Maintainability.

**UNIT IV FAILURE DATA ANALYSIS 9**

Statistical failures of components – failure distributions – Bath tub curve – Negative exponential distribution – Normal distribution - log normal distribution – Gamma distribution - Weibull distribution Life distribution measurements – Accelerated life tests - Data requirements for reliability.

**UNIT V RELIABILITY PREDICTION AND MANAGEMENT 9**

Failure rate estimates - Effect of environment and stress - Series and Parallel systems - RDB analysis – Standby Systems - Complex Systems - Reliability demonstration testing - Reliability growth testing - Duane curve - Risk assessment – FMEA and Fault tree analysis.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Khanna O.P., “Statistical Quality Control”, Dhanpat Rai Publications (P) Ltd., 2001.
2. Lewis E.E., “Introduction to Reliability Engineering”, John Wiley and Sons, 1987.

**REFERENCES:**

1. Zairi M., "Total Quality Management for Engineers", Woodhead Publishing Limited 1991.
2. Noori H. and Russell, "Production and Operations Management - Total Quality and Responsiveness", McGraw-Hill Inc, 1995.
3. Montgomery D.C., "Introduction to Statistical Quality Control", 2nd Edition, John Wiley and Sons, 1991.
4. Klaasssen H.B. and Peppen J.C.L, "System reliability concepts and applications", Edward Arnold, 1989.