A N N A M A L A I U N I V E R S I T Y

Faculty of Engineering and Technology

THREE YEAR DIPLOMA PROGRAMME IN MINING ENGINEERING REGULATIONS

R1.Condition for Admission:

Condition for admission to the first year of the three year Diploma Programme shall be required to have passed in

The S.S.L.C Examination of the board of Secondary Education, Tamilnadu

(or)

The Anglo Indian High School Examinations with eligibility for Higher Secondary Course in Tamilnadu

(or)

The Matriculation Examination of Tamilnadu.

(or)

Any other Examination recognized as equivalent to the above by the Board of Secondary Education, Tamilnadu.

R2. Eligibility for the diploma:

A candidate shall be (i). Eligible for a Certificate in Mining Engineering, if passed first year and discontinued the Programme (ii). Eligible for a Pre-Diploma Certificate in Mining Engineering, if passed up to second year and discontinued the programme and (iii). Eligible for a Diploma certificate, if the candidate has satisfactorily undergone the prescribed courses of study for a period of not less than three academic years and has passed the prescribed examinations in all the three academic years.

Candidates who obtained the certificate of Mining Engineering can also rejoin at a later date in the second year and who obtained the Pre-Diploma Certificate in the third year to complete the Diploma in Mining Engineering.

R3.Courses of study and Scheme of the Examinations:

The courses of study and the syllabi for the courses are given separately. The scheme of Examinations is also given separately.

R4.Duration of the programme:

A student is normally expected to complete the Diploma programme in three years but in any case not more than six years from the time of admission.

R5.Assessment:

The break-up of assessment and examination marks for theory and practical courses is as follows.

First assessment (Mid-term Test –I)	: 10 marks
Second assessment (Mid-term Test –II)	: 10 marks
Third Assessment	
(Assignment/Maintenance of Record Book)	: 05 marks
Examination	: 75 marks

The Practical Training/Project work will be assessed for 25/75 marks by a committee consisting of the guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the chairman by the Head of the Department. The Head of the Department may himself be a member or the chairman. 75/225 marks are allotted for the Practical Training/Project work and viva voce examination at the end of the semester.

R6. Student Counsellors:

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study.

R7.Attendance requirements:

To be eligible to appear for the examination in a particular course, a student must put in a minimum of 75% of attendance in that course. However, the Vice-Chancellor may give a rebate/concession not exceeding 10% in attendance for exceptional cases only on Medical grounds.

A student who does not meet the minimum attendance requirement in a course must re-register for and repeat the course.

R8.Criteria for passing the Programme:

A candidate is deemed to have passed in a course if he/she secures a minimum of 40% marks (30 Marks out of 75) in the final examination and a minimum of 50% marks in both final examination ad continuous assessment marks put together (50 marks out of Total 100 marks). Same minimum percentage of marks is adopted for passing the project work also.

R9.Classification of Successful Candidates:

A Candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters in the first appearance itself within the stipulated period of study (3 years) without any break

A Candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within 4 years.

All other successful candidates will be declared to have passed in **Second Class**.

R10.Ranking of candidates:

The candidates who are eligible to get the Diploma in First Class with distinction will be ranked together on the basis of the percentage of marks obtained by them in all the subjects of study from I to VI semester.

The candidates passing with First class will be ranked next after those with distinction on the basis of the percentage of marks obtained by them in all the subjects of study from I to VI Semester.

R11. Transitory Regulations:

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.

Diploma Programme in Mining Engineering
Course of Study and Scheme of Examinations

FIRST YEAR – FIRST SEMESTER

Course Code	Course	Periods / week			Duration of Exam Hrs.	Marks		
		L	T	P		CA	FE	Total
DMIC 101	Technical English I	4	0	0	3	25	75	100
DMIC 102	Mathematics I	4	0	0	3	25	75	100
DMIC 103	Engineering Physics	4	0	0	3	25	75	100
DMIC 104	Engineering Chemistry	4	0	0	3	25	75	100
DMIP 105	Physics Laboratory	0	0	3	3	25	75	100
DMIP 106	Chemistry Laboratory	0	0	3	3	25	75	100
DMIP 107	Computer Practice Laboratory	0	2	3	3	25	75	100
DMIP 108	Engineering Practices Laboratory	0	0	3	3	25	75	100
Total		**16**	**2**	**12**		**200**	**600**	**800**

L – Lecture T – Tutorial P – Practical CA- Continuous Assessment
FE – Final Examination

FIRST YEAR - SECOND SEMESTER

Course Code	Course	Periods / week			Duration of Exam Hrs.	Marks		
		L	T	P		CA	FE	Total
DMIC 201	Technical English II	4	0	0	3	25	75	100
DMIC 202	Mathematics II	4	0	0	3	25	75	100
DMIC 203	Material Science	4	0	0	3	25	75	100
DMIC 204	Chemistry for Mining Engineering	4	0	0	3	25	75	100
DMIC 205	Engineering Mechanics	4	0	0	3	25	75	100
DMIC 206	Mine Development	4	0	0	3	25	75	100
DMIP 207	Computer Aided Machine Drawing	0	3	3	3	25	75	100
DMIP 208	Manufacturing Technology Laboratory I	0	0	3	3	25	75	100
Total		**24**	**3**	**6**		**200**	**600**	**800**

SECOND YEAR - THIRD SEMESTER

Course Code	Course	Periods / week			Duration of Exam Hrs.	Marks		
		L	T	P		CA	FE	Total
DMIC 301	Mining Geology I	4	0	0	3	25	75	100
DMIC 302	Strength of Materials	4	0	0	3	25	75	100
DMIC 303	Mine Surveying	4	0	0	3	25	75	100
DMIC 304	Mining Environmental Engineering	4	0	0	3	25	75	100
DMIC 305	Surface Mining	4	0	0	3	25	75	100
DMIC 306	Drilling and Blasting	4	0	0	3	25	75	100
DMIP 307	Mine Development: Drilling and blasting Laboratory	0	0	3	3	25	75	100
DMIP 308	Mine Surveying Laboratory	0	0	3	3	25	75	100
Total		**24**	**0**	**6**		**200**	**600**	**800**

SECOND YEAR - FOURTH SEMESTER

Course Code	Course	Periods / week			Duration of Exam Hrs.	Marks		
		L	T	P		CA	FE	Total
DMIC 401	Mining Geology II	4	0	0	3	25	75	100
DMIC 402	Mining Machinery I	4	0	0	3	25	75	100
DMIC 403	Underground Mining Methods - Coal	4	0	0	3	25	75	100
DMIC 404	Rock Mechanics and Ground Control I	4	0	0	3	25	75	100
DMIC 405	Mine Ventilation	4	0	0	3	25	75	100
DMIC 406	Mineral Processing	4	0	0	3	25	75	100
DMIP 407	Mining Geology Laboratory I	0	0	3	3	25	75	100
DMIP 408	Mining Environmental Laboratory I	0	0	3	3	25	75	100
Total		**24**	**0**	**6**		**200**	**600**	**800**

THIRD YEAR - FIFTH SEMESTER

Course Code	Course	Periods / week			Duration of Exam Hrs.	Marks		
		L	T	P		CA	FE	Total
DMIC 501	Rock Mechanics and Ground Control II	4	0	0	3	25	75	100
DMIC 502	Underground Mining Methods Metal	4	0	0	3	25	75	100
DMIC 503	Mining Hazard and Safety	4	0	0	3	25	75	100
DMIC 504	Advanced Mine Surveying	4	0	0	3	25	75	100
DMIP 505	Mining Geology Laboratory II	0	0	3	3	25	75	100
DMIP 506	Mining Environmental Laboratory II	0	0	3	3	25	75	100
DMIP 507	Mining Machinery Laboratory	0	0	3	3	25	75	100
DMIP 508	Practical Training and Assessment	0	0	#	*	25	75	100
Total		**16**	**0**	**9**		**200**	**600**	**800**

Training in Mining Industry – 4 weeks
* Viva-Voce

THIRD YEAR - SIXTH SEMESTER

Course Code	Course	Periods / week			Duration of Exam Hrs.	Marks		
		L	T	P		CA	FE	Total
DMIC 601	Mine Management and Entrepreneurship	4	0	0	3	25	75	100
DMIC 602	Electrical Engineering & Mechanical Engineering	4	0	0	3	25	75	100
DMIC 603	Mining Machinery II	4	0	0	3	25	75	100
DMIC 604	Mine Sampling Assaying, Coal/ Mineral Processing	4	0	0	3	25	75	100
DMIP 605	Mine Hazard and Safety Laboratory	0	0	3	3	25	75	100
DMIT 606	Project Work	0	0	12	*	75	225	300
Total		**16**	**0**	**9**		**200**	**600**	**800**

*** Viva-Voce**

DMIC 101 -TECHNICAL ENGLISH I

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 favorite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words -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 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

Text Books:

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 PublishingCompany, 2007.

DMIC 102 - MATHEMATICS I

Unit I MATRICES

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

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

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

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.

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.

DMIC 103 - ENGINEERING PHYSICS

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 : focusing, 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- conductions in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radical 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 - CO2, 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.

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.

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.
3. Arumugam, M., Engineering Physics, Anuradha Publications, 2000.

DMIC 104 - ENGINEERING CHEMISTRY

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: Tg, 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.

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.

DMIP- 105 PHYSICS LABORATORY

List of Experiments

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. Optical fibre – Determination of Numerical Aperture and acceptance angle
7. Compact disc – Determination of width of the groove using laser
8. Acoustic grating – Determination of velocity of ultrasonic waves in liquids
9. Post office box – Determination of Band gap of a semiconductor
10. Spectrometer – Determination of wavelength using grating
11. Viscosity of liquids – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

DMIP – 106 CHEMISTRY LABORATORY

List of Experiments

1. Estimation of HCl using Na2CO3 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.

DMIP – 107 COMPUTER PRACTICES LABORATORY

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.

DMIP 108 - ENGINEERING PRACTICES LABORATORY

List of Experiments

Welding

1. Arc welding of butt joints, lap joints, T Joint.
2. Gas welding of butt joints, lap joints, T Joint.

Basic Machining

Simple turning, drilling and tapping operations. Machine assembly Practice.

Study and assembling the following: Centrifugal pump and air conditioners.

Demonstration on

1. Smith operations like the production of hexagonal bolt.
2. Foundry operation like mould preparation for grooved pulley.

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.

DMIC 201-TECHNICAL ENGLISH II

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 Books:

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.

DMIC 202- MATHEMATICS II

Unit I DIFFERENTIAL EQUATIONS

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

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 Stokes theorems – Verification and application in evaluating line, surface and volume integrals.

Unit III ANALYTIC FUNCTION

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

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

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.

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.

DMIC 203 MATERIALS SCIENCE

Unit I MECHANICAL PROPERTIES:

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

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

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 - baintic 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

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

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 semiconductos – photoconducting polymers – liquid crystals - Bio-sensors - Scintillation detectors (Position sensitive) –Bio materials – hydroxyapatite – PMMA – Silicone.

Text Books:

1. Raghavan, V., Materials Science and Engineering, Prentice Hall of India, 2007.
2. Palanisamy, P.K., Applied Materials Science, Scitech, 2003.

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
3. Raghavan, V., Physical Metallurgy, Prentice Hall of India, 2002.

DMIC 204- CHEMISTRY FOR MINING ENGINEERING

Unit I WATER TREATMENT

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

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

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

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

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.

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.

DMIC 205 - ENGINEERING MECHANICS

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.

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. Hibbeller, 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).

DMIC 206 - MINE DEVELOPMENT

Unit I INTRODUCTION TO MINING

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

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

Unit III SHAFT SINKING

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

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

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

Text 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,

References:

1. Chugh,C.P., Drilling Technology Hand Book, Oxford & IBH Publications, 1994.
2. Chugh,C.P. Diamond Drilling, Oxford & IBH Publishers, 1999.
3. Karnam,U.M.R., Principles of Rock Drilling, 1999.
4. Bhandari S., Engineering rock blasting operations, A. A. Balkema, 1997.
5. Cummings,A.B. and Given, I.A., SME Mining Engineers' Handbook, Vol.I and II, Society of Mining Engineers, New York, 1993.
6. Universal Mining School - Lecture notes, cardiff, U.K

DMIP 207 COMPUTER AIDED MACHINE DRAWING

Drawing Standards

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.

Fits And Tolerences

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.

Introduction To Drafting Package

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

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

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.

Text Books:

1. Gopalakrishna K.R., "Machine Drawing", 17th Edition, Subhas Stores Books Corner, Bangalore, 2003.
2. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 45th Edition, Charator Publishers, 2010

References:

Goutam Pohit and Goutam Ghosh, "Machine Drawing with AutoCAD", 1st Edition, Pearson Education, 2004

Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004

N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing" , published by Tata Mc GrawHill,2006

S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007.

DMIP 208 MANUFACTURING TECHNOLOGY LABORATORY I

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

DMIC 301- MINING GEOLOGY I

Unit I Physical Geology

Main branches of geology - Origin of earth – age of earth - structure and composition of the earth – earthquakes, volcanoes and mountains- basics of plate tectonics.

Unit II Geomorphology

Physiographic divisions of India. Concept of geomorphology - processes of weathering – development of river system - classification of seas – formation of glaciers – formation of lakes.

Unit III Mineralogy

Physical properties of minerals – rock forming minerals –physical and chemical properties of important rock forming minerals: quartz, feldspar, pyroxene, amphibole, mica, olivine and garnet group of minerals and calcite.

Unit IV Petrology

Classification of rocks – Description of igneous, sedimentary and metamorphic rocks – forms and mode of occurrence of igneous rocks. Common igneous rocks : granite, syenite, diorite and basalt. Common sedimentary rocks: sandstone, limestone, laterite and shale. Common metamorphic rocks: quartzite, slate, schist, gneiss and marble. Engineering properties of rocks.

Unit V Structural Geology

Dip and strike. Introduction to geological structures. Definition, classification and description of folds, faults, joints and unconformities. Criteria for recognition of fold and faults in the field and their significance in mineral exploration.

Text Books:

1. Parbin Singh. Geology for Engineers, IBH Publications, N. Delhi. 1991.
2. Arthur Holemess, Principles of Physical Geology, Thomas Nelson and Sons, USA, 1964.

Reference Books:

1. Blyth F.G.H. and De Freitas M.H. Geology for Engineers, 7th edition, Elsevier Publications, 2006.
3. Bell F.G. Engineering Geology, Elsevier Publications, 2007.
4. Ford, W.E. Dana's Textbook of Mineraology (4th edition), Wiley Eastern Ltd., N. Delhi, 1989.
5. Winter, J.D. An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, N. Delhi, 2001.
6. Billings, M.P. Structural Geology, Prentice Hall Ino., N. Jersey, USA, 1972.

DMIC 302 - STRENGTH OF MATERIALS

Unit I Stress, Strain And Deformation Of Solids

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumertric 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

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.

Unit III Torsion

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts- Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

Unit IV Deflection Of Beams

Double Integration method – Macaulay's method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

Unit V Thin Cylinders, Spheres And Thick Cylinders

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theory – Application of theories of failure.

Text Books:

1. Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., Strength of Materials, Asian Books Pvt. Ltd., New Delhi, 2007

References Books:

1. Egor. P.Popov " Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., Strength of Materials, oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., Mechanics of Materials, Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole Mechanics of Materials, Tata Mcgraw Hill publishing 'co. Ltd., New Delhi.

DMIC 303 - MINE SURVEYING

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 theodalite, Electronic Tachometer (Total station); Laser Theodalite; 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 SURVE 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.

Text Books:

1. Winniberg, F., Metalliferous Mine Surveying
2. Punmia, B.C., Surveying Vol I and II, Laxmi Publication, New Delhi, 1991

References Books:

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. Kenetkar, T.P., Surveying and Levelling, Vol I and Vol II, United Book Corporation, Poona, 1991.

DMIC 304 - MINING ENVIRONMENTAL ENGINEERING

Unit 1 Introduction

Man and Environment: Overview (socio-economic structure & occupational exposures) – Scope of Environmental Engineering – pollution problems due to urbanization & industrialization

Air Pollution and Water Pollution:

Causes of air pollution – types & sources of air pollutants- Climatic & Meteorological effect on air pollution concentration- formation of smog and fumigation.

Water Sources
Origin of waste water – Types of water pollutants and their effects

Different Sources of Water Pollution

Biological Pollution (point & non-point sources) – Chemical Pollutants: Toxic Organic & Inorganic Chemicals – Oxygen demanding substances – Physical Pollutants**:** Thermal Waste – Radioactive waste – Physiological Pollutants: Taste affecting substances – other forming substances

Unit – II Analysis of Air Pollutants

Collection of Gaseous Air Pollutants- Collection of Particulate Pollutants – Analysis of Air Pollutants like : Sulphur dioxide – Nitrogen oxide – Carbon monoxide – Oxidants &Ozone – Hydrocarbons – Particulate Matter

Air Pollution Control Measures & Equipment - Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods : Stacks Gravitational and Inertial Separation, Settling Chambers, Dynamic Separators, Cyclones, Filtration, Liquid Scrubbing, Spray Chambers, Packed Towers, Orifice and Ventury Scrubbers, Electrostatic Precipitators, Gas/solid Adsorption, Thermal Decomposition

Unit – III Methods & Approach of Air Pollution Control

Controlling smoke nuisance – Develop air quality criteria and practical emission standards – Creating zones suitable for industry based on micrometeorology of air area – Introducing artificial methods of removal of particulate and matters of waste before discharging to open atmosphere

Unit – IV Soil Polluting Agencies & Effect of Pollution

Liquid & Solid Wastes – Domestic & Industrial Wastes – Pesticides – Toxic**:** Inorganic & Organic Pollutants – Soil Deterioration – Poor Fertility, Septicity, Ground Water Pollution, Concentration of Infecting Agents in Soil

Solid Waste Disposal

Dumping domestic & Industrial Solid Wastes: Advantages & Disadvantages – Incineration: Advantages & Disadvantages – Sanitary Land Field: Advantages & Disadvantages – Management of Careful & Sanitary Disposal of Solid Wastes

Unit – V Noise Pollution & Control

Noise Pollution**:** Intensity, Duration – Types of Industrial Noise – Ill effects of Noise – Noise Measuring & Control – Permissible Noise Limits

Environmental Legislations, Authorities & Systems

Air & Water Pollution Control Acts & Rules (Salient Features only) – Functions of State / Central Pollution Control Boards – Environmental Management System**:** ISO 14 000 (Salient Features only

Text Books/ Reference Books

1. Kormondy, Concept of Ecology Prentice-Hall of India, New. Delhi
2. Odum, Fundamental of Ecology, Prentice-Hall of India, N.ew Delhi
3. J. Turk & A. Turk, Environmental Science
4. Dix, Environmental Pollution
5. Pollution Control Acts, Rules and Notification / Central Pollution Control Board, New Delhi
6. Dr. A.K. De, Environmental Chemistry
7. D. Lal, Water Supply & Waste Water

DMIC 305 - SURFACE MINING

Unit I INTRODUCTION

Important terms and definitions pertaining to surface mining operations. Introduction to surface mining methods. Status of surface mining, types of surface mine operations. Concept of stripping ratio, stripping economics, ultimate pit limits. Elements of surface mine planning. Major factors affecting exploitation of mineral resources.

Unit II LAYOUT AND DESIGN OF SURFACE MINES

Selection of mining method based on ore body characteristics. Cycles of mining operations.. Working pit slope and ultimate pit slope, various modes of slope failures, factors influencing slope stability, development of open-cast mine layouts, stripping methods using different machinery, Various layout problems and their solutions. Conversion of Underground mine to open-cast mines.

Unit III DEVELOPMENT OF SURFACE MINES

Removal and systematic storage of overburden. Formation of benches and bench parameters. Rock drilling methods, Explosives and blasting, sizing and loading of materials. Material handling and storage at surface mines. Outline of coal and lignite excavation by surface operation method. Outline of surface placer mining. Advantages and disadvantages of surface mining operations.

Unit IV EXCAVATION SYSTEM IN SURFACE MINES

Surface mining technology. 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 mines. Surface mining technology – Open-cast mining practices by bucket wheel excavators. Open-cast mining practices by Surface Miner. Problems of Deep open-cast mining.

Unit V TRANSPORT AND WASTE DUMPS

Scope and application of different modes of transport system in surface mines – Trucks, belt conveyors (shift able 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 stabilization measures. Health and safety in surface mining.

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.

References Books:

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 Hartman, H.L. (Ed.), SME Mining Engg. Handbook Vol. I and II, Society for Mining, Metallurgy, and Exploration, Inc., Colorado, 1992.
4. Pfleider, E. P, Surface Mining, 1st Edition, New York, 1968.
5. Konya, C.J. and Walter, E.J., Surface Blast Design, New Jersey, 1990.
6. Rzhevsky V., Open pit Mining Operations, Mir Publications, 1971.

DMIC 306 - DRILLING AND BLASTING

Unit I Exploratory Drilling

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

Production drilling; Various methods of drilling - percussive, rotary, rotary percussive, Factors affecting drilling; mechanics of drilling; drill ability 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

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

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

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.

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.

References Books:

1. Kennedy, B.A., Surface Mining – 2nd Editions, SME, New York, 1990.
2. Pijush Pal Roy., Rock blasting: effects and operations, A.A. Balkema, Rotterdam, 2005.
3. Clark, G.B., Principles of Rock fragmentation, Wiley Interscience Publication, 1987.

MIP 307 - Mine Development Drilling and Blasting Laboratory

List of Experiments

1. Study of accessories of boring machines and boring rig.
2. Study, sketch & use of the boring and fishing tools.
3. Study and sketch of Hydraulic feed mechanism of the drilling machine.
4. Study and sketch of double tube core barrel
5. Study and sketch of various types of detonators and relay
6. Study of different types of exploders.
7. Study of construction and use of stemming rods, scraper cum break detector, blasting cable, circuit tester etc
8. Study and sketch of approved types of explosive magazines
9. Study & sketch of different types of initiation.
10. Study & sketch of Hydraulic Splitter / Cordex

DMIP 308 - MINE SURVEYING LABORATORY

List of Experiments

1. Theodolite traverses survey.
2. Method of co-ordinates.
3. Close traversing by Theodolite & balancing by Bowditch rule & transit rule.
4. Study of Miners Dial its constructional features & adjustments
5. Study of measurement of Depth of a vertical shaft.
6. Study of measuring subsidence.
7. Determine the true apparent dip & strike from bore hole data.

DMIC 401 - MINING GEOLOGY II

Unit I Economic Geology

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

Unit II Economic Mineral Deposits

Metallic and 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, occurrence and Indian distribution of industrial minerals-ceramic, refractory, abrasive, glass and natural pigments.

Unit III Coal And Petroleum Geology

Origin, physical properties, processes, occurrence of coal and its types, petroleum deposits. Petroliferous basins of India. Ore reserve estimation and UNFC.

Unit IV Mineral Exploration

Methods of investigation ore bodies- rock sampling techniques ore reserve estimation methods and UN framework classification (UNFC). Coal and petroleum reserve calculation. Geophysical prospecting methods – Introduction. Seismic, electrical, magnetic and gravity methods of mineral prospecting.

Unit V Remote Sensing Application In Geological Studies

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

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. Umeshwar Prasad, Economic Geology: Economic Mineral Deposits, CBS Publishers & Distributors, 2014.

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.
4. Umathay, R.M., Text book of Mining Geology, Dattsons , 2002.
5. Arogyaswamy, R.N.P., Courses in Mining Geology, Oxford and IBH Co., New Delhi, 1988.

DMIC 402 - MINING MACHINERY- I

Unit I: Wire Ropes

Usage, chemical composition, infield tests of wire, classification of wire ropes, applicabilities of different ropes - causes of deterioration, precautions, selection parameters - computation of numerical problems on size - Weight and strength of wire ropes. Capping and recapping of wire ropes, classification - description of capping methods - splicing methods, description of splicing

Unit II: Transportation In Mines -Rope Haulages

Purpose of transportation, comprehensive classification of transportation - ROPE HAULAGE - direct Rope Haulage System, merits, demerits and applications - safety Devices in Direct Rope Haulage system-Endless Rope Haulage System, merits, demerits and applicabilities safety devices - Laying and maintenance of track- constructional details of mine tub/car -factors of selection for rope haulage serial rope ways- computation problems for determination of H.P. rope size breaking strength, Tub capacity, number of tubs.

Unit III: Transportation In Mines -Conveyors

Conveyor usage, classification - belt conveyor system, different types of belt constructions, safety devices merits, demerits and limitations of Best conveying system - compilation of numerical problems to find the material quantity H.P. length and inclination of haulage, tensing strength breaking strength of belt amount of slip. Scraper chain convey or system, protective devices-merits, demerits and limitation.

Unit IV: Transportation In Mines –Locomotives & Ariel Ropeways

Transportation in Mines -Locomotives & Areal rope ways -Classify loco haulage systems, merits, demerits, applicabilities of different system - clarifies aerial roper ways, the applicable conditions of aerial ropeways.

Unit V: Introduction To Coal Processing/Beneficiation Machinery

Why beneficiation-methods of beneficiation- quality control-material handling while beneficiation - rushing-screening stacking-washing, Tailings dam-disposal of tailings - Coal washery & washing of coal etc.

Text Books:

1. Handbook of Metalliferous Mining Methods by Y.P.,Chacharkar, Lovely Prakashan, Dhanbad.
2. Elements of Mining Technology, D.J.Deshmukh Vol.3

References Books:

1. Mine Transport by Kerlin
2. Introduction to mining, G.K, Pradhan, Mintech Publications, Bhubaneswar

DMIC 403 - UNDERGROUND MINING METHODS - COAL

Unit I Introduction

Status of coal industry and deposit factors affectıng choice of mining methods, classification of mining methods, grading and analysis of coal.

Unit II Bord And Pillar Method-Development

Design and development of a district, bord and pillar, room and pillar methods, with conventional and ontinuous mining techniques; panel system.

Unit III Bord And Pillar Method – Extraction

Pillar extraction by caving and stowing methods; mechanised extraction of pillars, shaft pillar extraction, systematic supports, surface, underground and face arrangements for stowing.

Unit IV Longwall Method

Advance and retreat methods, continuous and cyclic systems, extraction with different machines- loughs, shearers, design of long wall workings, optimum length of face, size of panel, gates, support system, personnel, organisation and safety measures, salvaging in long wall.

Unit V Special Methods Of Working

Problems of working thick & thin seams, multi slices, sublevel caving, horizon mining, gallery blasting method, contiguous seam working, working steeply inclined seams, working under surface structures and seams liable to spontaneous heating, outburst and bumps, etc. hydraulic mining, wongawali, shortwall, underground coal gasification, shield mining.

Note: All the above are to be covered with emphasis on CMR and the relevantcirculars

Text Books:

1. Singh, R.D. Principles and Practices of Modern Coal Mining, New Age International (P) Ltd., Chennai, 1994.
2. Singh, T.N. Singh, Underground Winning of Coal – Oxford & IBH Publishing Co. Ltd., 1992.

References Books:

1. Mathur, S.P., Coal Mining in India, M.S. Enterprises, Bilaspur,1999.
2. Das S.K., Modern Coal Mining technology, Lovely Prakashan, Dhanbad1994.
3. Singh T.N., Dhar, B.B. Thick Seam Mining, Problems and Issues, Oxford & IBH Publishers, 1992.
4. Mathur, S.P., Mining Planning for Coal., M.G. Consultants, Bilaspur,1993.
5. Peng S.S., and Chiang, H.S., Longwall Mining, John Willey and Sons, New York, 1992.
6. Szwilski and Richards M.J., Underground Mining Methods and Technology, 1987. Internet: www.miningindia.com

DMIC 404 - ROCK MECHANICS AND GROUND CONTROL I

Unit I Introduction
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
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
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
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
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.

Text Books:

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. Peng, S.S., Ground Control, Wiley Interscience, New York, 1987.

References Books:

1. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
2. Hoek, E., and Brown, S.T., Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980.

DMIC 405 - MINE VENTILATION

Unit I Mine Gases

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

Psychometrics 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. Psychometrics surveys.

Unit III Principal Laws Of Air Movement In Underground

Fundamentals of fluid flow and its application in mine ventilation with special reference to Bernoulli's Equation, Reynolds number, Poiseuille 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

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

Unit V Mechanical Ventilation & Ventilation Planning

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 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 covered with emphasis on CMR,MMR and the relevant circulars by the faculty.

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.

DMIC 406 - MINERAL PROCESSING

Unit I Introduction

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 Comminution

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

Purpose, factors governing particle behaviour, laboratory and industrial screen, 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

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

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.

Text Books:

1. Jain, S.K., Ore Processing, Oxford – IBH Publishing, 1984.
2. Gaudin, A.M., Principles of Mineral Dressing – McGraw Hill Book Company, 1971.

References Books:

1. Taggart, A.F., Handbook of Mineral Dressing, John Wiley and Sons, New York, 1990.
2. Wills, B.A. Mineral Processing Technology, Pergamon Press, 1985.
3. Vijayendra, H.G., Handbook on Mineral Dressing, Vikas Publishing House Pvt. Ltd. 1995

DMIP- 407 MINING GEOLOGY LABORATORY I

List of Experiments

1. Study of physical properties of minerals.
2. Study and identification of important rock forming minerals in hand specimen
3. Megascopic studies of important igneous Rocks.
4. Megascopic studies of important sedimentary Rocks.
5. Megascopic studies of important metamorphic Rocks.
6. Study and Identification of important economic minerals in hand specimen
7. Study and sketch of model showing different types of faults, folds and their relations to photography.

DMIP 408 MINING ENVIRONMENTAL LAB I

List of Experiments

1. To determine the psychometric 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.
4. Study of mine flame safety lamp, gas testing with flame safety lamp, electric cap lamps, lamp room layouts and illumination survey.
5. Study of air-reversal arrangement in mine fans.
6. Study of pressure survey and quantity survey in mines using velocity meter, anemometer and barometer.
7. Determination of air born dust by gravimetric dust sampler, personal dust sampler and by high volume sampler.
8. Noise survey.
9. Determination of crossing point temperature and index of inflammability.
10. Study of self rescuers of different types.
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

DMIC 501 - ROCK MECHANICS AND GROUND CONTROL II

Unit I **Rock Mechanics Instrumentation**

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

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, pseudomining 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, 80 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

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

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

Text Books:

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.

References Books:

1. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
2. Hoek, E and Brown, E.T., Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980.
3. Peng, S.S. Ground Control, Wiley Interscience, New York, 1987.

DMIC 502 - UNDERGROUND MINING METHODS - METAL

Unit I Basics

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.

Unit II General Mine Design

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.

Unit III Stoping – General Description

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.

Unit IV Stope Planning And Layout

Preparing a stoping block; sequence of stoping; organization; production cycle; Unit cost calculation; comparison of methods and costs

Unit V Novel Innovative Techniques & Special Applications

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. Cast studies of Indian and foreign underground metal mines.

Note: All the above are to be covered with emphasis on MMR and the relevant circulars

Text Books:

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. Hustrulid, W.A. Ed., Underground Mining Methods Handbook Society of Mining Engineering, AMIE, New York, 1990.

DMIC 503 - MINING HAZARDS & SAFETY

Unit I: Mine Fires

Spontaneous Heating, Different stages: Determination of proneness of coal by crossing point, Factors governing proneness to spontaneous combustion, Detection of spontaneous heating symptoms, Preventive measures, Including pannel system layout, Adequate ventilation provisions in design stages, Regular inspections etc.

Unit II: Fires

Underground & quarry fires: Causes of mine fires, Dealing with mine fires, Sealing off, different types of stopping, construction & purposes, Pressure balancing to control air leakage into sealed off fire-areas, Methods of collection of air samples from sealed off fire - areas and from mine atmosphere, Recovery of sealed off mine working on account of fire by reopening.

Unit III Dealing With Fires In Quarry:

Debris, Coal pillars & coal stocks different types of fire extinguishers safety & statutory aspects.

Unit IV: Mine-Explosions:

Fire Damp Explosions:
Limits of inflammability & various factors influencing the same, Causes of fire damp explosions, Preventive measures.

Unit V: Coal Explosions:

Coal Dust Explosions Causes:
Factors affecting inflammability of coal dust, Causes of & preventive measures against coal dust explosions, Various stone dust, Types & efficiency, Stone dusting, Stone dust barriers water barriers & triggered barriers, Organization for stone dust treatment of coal dust, Sampling procedures of roadways mine dusts apparatus & organization, Safety & statutory aspects.

Text Books:

1. Elements of Mining Technology Vol-2, D. J. Deshmukh .
2. Mine Disasters and Mine Rescue - M.A. Ramlu, Oxford & IBH, New Delhi.

References:

1. Hand book on First Aid, Published by Multi Disciplinary Centre on Safety, Health & Environment, Bhubaneswar
2. Mine Safety & Legislation, by S.K.Das, Lovely Prakashan, Dhanbad. Mine Rescue

Rules.

DMIC 504 – ADVANCED MINE SURVEYING

Unit I: Theodolite

Magnetic bearing of lines. Traversing - continuous Azimuth, double for sight methods - computation of bearings of traverses check of accuracy in angular measurements - permissible error - distribution - calculation of latitude and departure - problems on rectangular coordinates - calculation of areas - Bowditch Rule

Unit II: Triangulation

Definition - Principles - classification mine Triangulation - scheme of Triangulation - Checks for measuring angles in Triangle - selection of stations - points considered for selection of stations - Baseline measurement in catenary, on level ground - Connections applied on base line determination of true north by astronomical observation method of extension of base line.

Unit III: Setting Curves

Classification - Definitions - elements of simple curve - Method of setting out curves - by chord and offset, chard and angle.

Correlation survey - Purpose - methods of correlation - Direct Traversing - Co - planning - Weisbach Triangle.

Unit IV: Tachometry

Principles - systems - Constants Methods - Stadia method, substance method, Tangential method -merits and demerits of Tachometry - relation between stadia reading, Horizontal distance, vertical distance, solves problems.

Unit V: Stope Survey

Objectives - Methods - Tap Triangulation - Field of application - Typing method Radial Ray method - prepare stope sheets - stope plans with details

Modern surveying Instruments: - Principle of working of - EDM - GPS - Total station Instrument - applicability in Mines.

Textbooks:

1. Surveying : Kanetkar & Kulkarni Vol 1,2
2. Surveying : Punmia Vol. 1,2,3

References:

1. U.M.S Volumes
2. Surveying : Ghatak Vol.1,2,3

DMIP 505 - MINING GEOLOGY LABORATORY II

Ore Geology

Physical identification of metallic ores of iron, manganese, lead, zinc, copper, chromite and bauxite. Physical identification of non-metallic ores graphite, asbestos, ochres, garnet, silimanite, vermiculite and mica. Physical identification of lignite and coal.

ORE RESERVE ESTIMATION

Grid map preparation, iso-chore and iso-pach map preparation. Ore reserve estimation by conventional methods. Assessment of coal and lignite reserves from contour maps. Determination of Engineering properties of rocks.

Remote Sensing & Geophysics

Study of aerial photographs and satellite imageries. Interpretation of geological geomorphological features from aerial photographs and satellite imageries. Electrical resistivity survey and interpretation of electrical data.

Geological Field Work

Geological mapping of igneous, sedimentary and metamorphic terrains. Identification of minerals and ores in the field site. Preparation of lithology and structural maps.

References:

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

DMIP 506 – MINING ENVIRONMENTAL LAB II

List of Experiments

1. Determination of CO, NOx, CH4, H2S, SO2, O2, CO2, by corresponding analyzers.
2. Study and application of infrared gas analyzer.
3. Detection of methane by different types of methanol meters & frame safety lamp.
4. Study and uses of proto – IV, Proto – V. Dragger – BG – 174 self contained breathing apparatus
5. Study and uses of self rescuer Gas mask, smoke helmet.
6. Study and use of reviving apparatus
7. Study of Born-Side safety boning apparatus.
8. Various types of CO-detectors used in mines and their selection criteria
9. Measurement of relative humidity with the help of various types of hygrometer.
10. To find the effect of heat, humidity and air velocity with the help of Kata-thermometer

DMIP – 507 MINING MACHINERY LABORATORY

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 meance of attachment of tubs to the rope.
4. Study of haulage track, curves, diamond crossing, construction of Mine tubs and cars along with their couplings.
5. Study of safety devices provided of haulage roads and locomotives - Exhaust conditioning and flame traps & underground Battery charging station layout
6. Electrical power distribution in mines, electrical layout for rope haulages and pumps, Electrical and hydraulic layouts for long wall faces
7. Study of aerial rope ways – driving/tensioning/loading/unloading and angle stations
8. Study of various types of head gear-fleet angle, Study of shaft fittings-signal systems, guides, safety dogs and protective roofing, study of guides– methods of support and tensioning arrangements.
9. Study of fittings of winding engines- drums, brakes, and depth indicators.
10. Study of different types of conveyors like armored face conveyors, belt conveyors, gate belt conveyors, shaker & vibrating conveyors, high angle conveyors
11. Study of coal drill and its electrical panel/gate end box
12. Study of coal ploughs and shearers
13. Study of continuous minors and road headers
14. Study of pit top & pit bottom layouts in shaft and incline under various conditions.
15. Study of different types of loading machines.
16. Study of earth mining equipments (Diesel Engine) & Hydraulic circuits

DMIP 508 - PRACTICAL TRAINING AND ASSESMENT

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 organization provide training. The students have to submit a report on the training which would be evaluated during the ensuing V Semester. The training report will be evaluated similar to the Project work.

DMIC 601 - MINE MANAGEMENT AND ENTREPRENEURSHIP

Unit I: Mine management

Role of mining Industry in country's economic development, ownerships of Industries, Management, organisation, in the context of mining Industry.

Unit II: Entrepreneurship

Motivating factors, Risks and Rewards, requirements self employment schemes, products selection. site solution, plant layout, setting of a mine, Market survey. Feasibility report, Man Power requirement, techno-economic and cost factors.

Unit III: **Work Study**

Work study**,** principle of workstudy, scope and necessity of workstudy, Method study, advantages of Method study, time study and principle of time study

Unit IV: Industrial Dispute Act-1947

Industrial Dispute act-1947 causes f or Industrial Dispute adverse effects for Industrial Dispute various provisions of ID act works committee, conciliation officer, Bord of conciliation court of enquiry, industrial tribunal, voluntary organisation, strike and lockout.

Unit V: Total Quality and Management

Concepts of Quality and its use in mine production.

Text Books:

1. Mine Management, Legislation and Ground safety : S. Ghatak
2. Mine Management : V.N. Singh

References:

1. Industrial Management : O.P. Khanna
2. Industrial Management : Jain and Bhanu
3. Mines act 1952
4. Mines rules 1955
5. CMR/MMR 1957 / 61
6. Critical Appraisal : Rakesh & Prasad
7. Mineral Economics : D. J. Deshmukh
8. Encyclopaedia of Mining Laws
9. Mine safety and disaster : C.P.Singh

DMIC 602 - ELECTRICAL ENGINEERING & MECHANICAL ENGINEERING

Unit 1

D.C. Generators: Construction - main parts, materials their made of, function of the parts. Deduction of emf equation and simple problem Application of D.C. Generators.

D.C. Motor: Principle of operation and classification. Speed equations and speed control of shunt and series motor-armature resistance control and field control only-reversal of direction of rotation. Application of D.C. motors.

A.C. Generators/ Alternators: Construction - main parts-rotor, stator, slip ring and brushes, excitors and their function. Principle of operation , classification and uses.

Unit II

A.C. - 3 phase systems: Connections: a) Star connection- 3 phase, 3 wire and 4 wire systems. b) Delta connection - 3 phase 3 wire systems. Relation between line & phase values of voltage & current - in each case and expression for power. Advantages of 3 phase system over single phase system.

Transformers: Construction & principle of operation of single phase transformers. E.M.F. equation and deduction of the relations - N1/N2 = E1/E2 = l1/l2. Connections of 3 phase transformers
a) Star / Star. b) Delta/Delta c) Star/ Delta d) Delta / Star. (connections only)
Applications of Transformers.

Starters:
a) D.O.L & star/delta starter for squirrel cage motors.
b) Rotor- Rheostat starter for slip ring motor.

Reversal of direction of rotation & uses of 3 phase induction motor.

Storage Batteries (Lead acid cell): Construction - different parts, materials they are made of and their functions. Charging - different methods, conditions of full charge. Defects, maintenance & uses.

Unit III

Stress & Strain: Simple stress and strain, Hook's law, Poisson's ratio, stress-strain diagram (Mild steel only) - Elastic limit, yeild point, ultimate strength, working stress, factor of safety, elastic constants & relationship among them (deduction not required).
Steam & Boiler: Heat and temperature, absolute pressure and temperature, conversion of heat into mechanical work, properties of steam, sensible heat, latent heat of evaporation, wet, dry and superheated steam; enthalpy of steam, (use of steam table). Functions of boilers and their classification, brief description and working principles only of the following boilers - Cochran, Lancashire and Babcock Wilcox. Locations & functions only of the following boiler mountings and accessories - water level indicator, fusible plug, pressure gauge, stop valve, safety valve, economiser, super heater, air preheater and feed pump.

Unit IV

Fluid Mechanics: Properties of fluid, pressure of fluid, pressure head of liquid, pressure gause such as piezometer tube, manometer, fluid flow, equation of continuity of flow, Bernoulli's theorem(proof not required), venturimeter- simple numerical problems. Centre of pressure and depth of centre of pressure on flat surface vertically immersed in a liquid(no proof) problems only. Flow of liquid through notches-definition of notch, type of notches- rectangular notch, triangle notch, formula of discharge through notches (proof not required). Simple numerical problems no discharge.

Unit V:

Compressed Air: Compressed air as power. Different types of compressions and compressors, work done and HP required for compression(problems on single stage air compressor only), effect of clearance volume, multistage compressors, inter coolers and after coolers, Compressors air transmission and losses in transmission and storage, advantages of use of compressed air in mine. Study of compressed air machines- air turbine only.

Text Books:

1. Theraja. B. L., "A text book of Electrical Technology", S. Chand&Co., New Delhi, 2005.
2. Ballaney P.L., Thermal Engineering, Khanna Publishers, New Delhi, 24 th ed.2003.

Reference Books:

1. Rajput. R. K., "A text book of Electrical Machines", Lakshmi Publications, 2006.
2. Khurmi R.S., Thermal Engineering, S.Chand& Co., New Delhi.14th ed.2005

DMIC 603 - MINING MACHINERY II

Unit I: Coal face machinery

a) Hand held drills - classification Electronic Rotary drills: Hammer Drills, Epicyclical gear Arrangement-b) Power Loader - Types of loaders, field of applications, working operation-Principle, design and application of long wall face machinery shearer, AFC, Lump breaker - stage loader, power pack self advancing chock shield supports- SERDS and DERDS- their applications- principle of working of AFC (Armoured Face conveyor)- names the constituent parts of AFC-application of Twin Bord AFC, bottom closed AFC- safety devices associated with AFC drive- principle of lump breaker- purpose of power pack- Sequences of overburden Movements in a long wall Panel- classification and capability of the immediate roof in long wall panel- Abutment Pressures in long wall mining- classification of Powered supports in long wall mining- factors governing the selection of power supports- purpose of the following in Power supports

a. Canopy
b. Caving Shield
c. Lamniscate Links-
d. Extension Canopy
e. Face Guard
f. Double acting Advancing Ram- composition of Hydraulic fluid- types of Hydraulic control systems.

Unit II :Flameproof and intrinsically safe apparatus-

Outlines the necessity, FLP vs intrinsically safe apparatus field of application, Frame proofing - constructional features methods of intrinsic safety field or application Remote control principle.

Unit III: Signaling

Method of signaling in mines - electrical signaling, circuit indicators - Mining telephones operation.

Unit IV :Winding

Winding in shafts - purpose, equipment, Types of had gear frames -Shaft fittings - guides in the shafts - pit - top arrangement - keps and suspension gear - Types of drums. Head gear pulley, care skip winging-pit-top and pit-bottom arrangements - Drum winding and skip winding, multi-deck winding and friction winding - Drum and friction winding - Winding engine - depth indicator slow banking arrangement - Methods of speed control - Breaking in winding - Types of breaks.

Unit V :Mine Pumps:

Pumping - Various terms of pumping, classification of pumps - centrifugal pump fittings - Turbine pump, fittings - Eudthrust - submersible pump - fittings Roto Pump, merits limitation - Selection of pumps - computation of numerical problems on Head, Quantity, H.P. Frictional losses.

Text Books:

1. Elements of mining science and Art of mining Digest : D.J Deshmuku Vol.3
2. U.M.S. Volumes

Reference:

1. Statham series Vol.3
2. Mine transport: Kerlin
3. Introduction to mining Engineering : Hartment

DMIC 604 - MINE SAMPLING ASSAYING AND MINERAL PROCESSING

Unit I : Mine Sampling:

Definition, terms, purpose and various uses. Different Sampling Methods. Salting-purpose, safety against salting. Reduction of sampling- Methods used.

Unit II : Assaying:

Introduction - assay map, assay plan factor, assay values, grade value, tenar, type of grade value. Calculations based on average assay value. Estimation of ore reserves.

Unit III : Mineral Dressing:

Scope, objectives & limitations of Mineral Dressing. Comminution. Size separation. Gravity concentration methods. Introductory froth floatation. Simplified flow sheets of coal, copper, Lead & zinc, iron, limestone's (Briefly).

Unit IV: Coal Processing :

Characteristics of Indian Coal, Why Coal processing is needed? Constituents of coal and their role - Specification of coal to be used in steel plants (for coking coal) and other plants (power plants, cement plants etc),

Unit V: Coal Benification:

Coal quality improvement while mining, Coal handling, dry coal beneficiation, Wet coal beneficiation.

Text Books:

1. Mineral dressing : Gaudin
2. Mine economics : Sinha & Sharma

References:

1. Element of mining : DJ.Deshmukh
2. U.M.S.
3. Mine economics : A.Kumar

DMIP 605 - MINE HAZARD AND SAFETY LAB

List of Experiments

Study of constructional features & working of self contained breathing apparatus.

1. Study of various types of Fire Extinguishers used in Mines.
2. Study of constructional features & working of self Rescuer.
3. Study of constructional features & working of Gas Mask.
4. Study of constructional features & working of Reviving apparatus.
5. Study of working of Burn Side Safety Boring Machine.
6. Study of constructional features & working of Stone Dust Barriers.
7. First aid training to be explained and conducted.

DMIP 606 - PROJECT WORK

Course Contents

Identification of the Project- Collection of data- Organisation of the data- Design of Project elements - Preparation of drawings- Schedules and sequence of operations- Preparation of charts and models- Preparation of report

Objectives

- Identify different works to be carried out in the project.
- Collect data relevant to the project.
- Arrive at efficient method from the available choices based on preliminary investigation.
- Design the required elements of the project as per standard practices.
- Prepare working drawing for the project.
- Prepare schedule of time and sequence of operations.
- Prepare charts or models for each project.
- Prepare project report.

Project may be selected from among the following suggested topics
Underground mining (coal)

1. Bord and pillar mining method Longwall mining method.
2. Blasting gallery method.
3. Stoping methods for non-coal mining Mechanised stoping methods for non-coal mining

Opencast mining

1. Pillars extracting by open cast method(coal)

2. Mechanised opencast mining.
3. In Pit crushing technology Surface mining technology Blasting