Mahakaushal University, Jabalpur (M.P.)

Scheme & Syllabus

For

B.Tech

in

Mining Engineering

2021-2022 onwards

Duration of Course: 4 Years
Examination Mode: Semester
Examination System: CBCS

Mahakaushal University
Village-Aithakheda, Mukunwara Road, Post- Tilwara Jabalpur (M.P.) 482003

Engineering Chemistry

Course Contents:

(i) Water – Analysis, Treatments and Industrial Applications (4 Lectures)

Sources, Impurities, Hardness & its units, Determination of hardness by EDTA method, Alkalinity & It's determination and related numerical problems.

(ii) Boiler problem & softening methods (4 Lectures)

Boiler troubles (Sludge & Scale, Priming & Foaming, Boiler Corrosion, Caustic Embrittlement), Softening methods (Lime-Soda, Zeolite and Ion Exchange Methods) and related numerical problems.

(iii)Lubricants and Lubrication (4 Lectures)

Introduction, Mechanism of lubrication, Classification of lubricants, significance & determination of Viscosity and Viscosity Index, Flash & Fire Points, Cloud & Pour Points, Aniline Point, Acid Number, Saponification Number, Steam Emulsification Number and related numerical problems.

(iv)Polymer & polymerization (4 Lectures)

Introduction, types of polymerisation, Classification, mechanism of polymerisation (Free radical & Ionic polymerization). Thermoplastic &Thermosetting polymers Elementary idea of Biodegradable polymers, preparation, properties & uses of the following polymers- PVC, PMMA, Teflon, Nylon 6, Nylon 6:6, Polyester phenol formaldehyde, Urea- Formaldehyde, Buna N, Buna S, Vulcanization of Rubber.

(v) Phase equilibrium and Corrosion (5 Lectures

Phase diagram of single component system (Water) Phase diagram of binary Eutectic System (Cu-Ag.) Corrosion: Types, Mechanisms & prevention.

(vi) Spectroscopic techniques and application (6 Lectures)

Principle, Instrumentation & Applications, electronics spectroscopy, Vibrational & Rotational Spectroscopy of diatomic molecules.

(vii) Periodic properties (4 Lectures)

Effective Nuclear Charge, Variations: S, P, d & f Orbital energies of atoms in periodic table, Electronics Configuration, atomic & Ionic sizes, electron affinity & electro negativity, Ploarizability & Oxidation States.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular

energy levels in various spectroscopic techniques

- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Practical List

NOTE: At least 8 of the following core experiments must be performed during the session.

1. **Water testing**
   - **(i)** Determination of Total hardness by Complexometric titration method.
   - **(ii)** Determination of mixed alkalinity
     - a) **OH & CO3**
     - b) **CO3 & HCO3**
   - **(iii)** Chloride ion estimation by Argentometric method.

2. **Fuels & Lubricant testing:**
   - (i) Flash & fire points determination by
     - a) Pensky Martin Apparatus,
     - b) Abel's Apparatus
     - c) Cleveland's open cup Apparatus
     - d) Calorific value by bomb calorimeter.
   - (ii) Viscosity and Viscosity index determination by
     - a) Redwood viscometer No.1
     - b) Redwood viscometer No.2
   - (iii) Proximate analysis of coal
     - a) Moisture content
     - b) Ash content
     - c) Volatile matter content
     - d) Carbon residue
   - (iv) Steam emulsification No & Anline point determination
   - (v) Cloud and Pour point determination of lubricating oil

3. **Alloy Analysis**
   - (i) Determination of percentage of Fe in an iron alloy by redox titration using N-Phenyl anthranilic acid as internal indicator.
   - (ii) Determination of Cu and or Cr in alloy by Iodometric Titration.
   - (iii) Determination of % purity of Ferrous Ammonium Sulphate & Copper Sulphate.

Reference Books :

1 Chemistry in Engineering and Technology - Vol.1 &2 Kuriacose and Rajaram , McGraw Hill Education

2 Fundamental of Molecular Spectroscopy C.N. Banwell , McGraw Hill Education

3 Engineering Chemistry – B.K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut.

4 Basics of Engineering Chemistry – S.S. Dara & A.K. Singh, S. Chand &Company Ltd., Delhi.

5 Applied Chemistry – Theory and Practice, O.P. Viramani, A.K. Narula, New Age International Pvt. Ltd. Publishers, New Delhi.

6 Elementary Spectroscopy ,Y .R. Sharma , S. Chand Publishing

7 Polymer Science, Vasant R. Gowariker N. V. Viswanathan Jayadev Sreedhar, New Age International Pvt. Ltd

8 Advanced Inorganic Chemistry, G.R. Chatwal, Goal Publishing house

9 Engineering Chemistry (NPTEL Web-book) B.L. Tembe, Kamaluddin and M.S. Krishna

ENGG. MATHEMATICS-I

OBJECTIVES: The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:

To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.

To familiarize the student with functions of several variables that is essential in most branches of engineering.

To develop the essential tool of matrices and linear algebra in a comprehensive manner.

Course Contents:

Module 1: Calculus: (10 hours): Rolle's theorem, Mean Value theorems, Expansion of functions by Mc. Laurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two and three variables), Method of Lagranges Multipliers.

Module 2: Calculus: (8 hours): Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Multiple Integral, Change the order of the integration, Applications of multiple integral for calculating area and volumes of the curves.

Module 3: Sequences and series: (6 hours): Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Vector Spaces (8hours): Vector Space,Vector Sub Space, Linear Combination of Vectors,Linearly Dependent, Linearly Independent, Basis of a Vector Space,Linear Transformations.

Module 5: Matrices (8 hours): Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Communication skills

COURSE CONTENTS:

Unit-I

Identifying Common errors in writing: Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Sentence Structure.

Unit-II

Vocabulary building and Comprehension:

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, synonyms, antonyms, Reading comprehension.

Unit-III

Communication:

Introduction, Meaning and Significance, Process of Communication, Oral and Written Communication, 7 c's of Communication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students, nonverbal communication.

Unit-IV

Developing Writing Skills:

Planning, Drafting and Editing, Precise Writing, Précis, Technical definition and Technical description. Report Writing: Features of writing a good Report, Structure of a Formal Report, Report of Trouble, Laboratory Report, Progress Report.

Unit-V

Business Correspondence:

Importance of Business Letters, Parts and Layout; Application, Contents of good Resume, guidelines for writing Resume, Calling/ Sending Quotation, Order, Complaint, E-mail and Tender.

Books Recommended:

1. 'Technical Communication : Principles and practice', Meenakshi Raman and Sangeeta Sharma (Oxford)
2. 'Effective Business Communication', Krizan and merrier (Cengage learning)
3. 'Communication Skill, Sanjay Kumar and pushlata, OUP2011
4. "Practical English Usage Michael Swan OUP, 1995.
5. "Exercises in spoken English Parts I-III CIEFL, Hyderabad, Oxford University Press
6. On writing well, William Zinsser, Harper Resource Book 2001.
7. Remedial English Grammar, F.T. Wood,Macmillan2007.

Course Outcomes:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Communicative Language Laboratory:

Course objective: The language laboratory focuses on the practice of English through audio-visual aids and Computer software. It intends to enable the students to speak English correctly with confidence and intends to help them to overcome their inhibitions and self –consciousness while speaking in English.

Topics to be covered in the Language laboratory sessions:

1. Listening Comprehension.
2. Pronunciation, Intonation, Rhythm
3. Practising everyday dialogues in English
4. Interviews.
5. Formal Presentation

Final Assessment should be based on assignment, assessment, presentation and interview of each candidate.

Basic Electrical & Electronics Engineering

Course Contents:

Unit- I :

D.C. Circuits: Voltage and current sources, dependent and independent sources, Units and dimensions, Source Conversion, Ohm's Law, Kirchhoff's Law, Superposition theorem, Thevenin's theorem and their application for analysis of series and parallel resistive circuits excited by independent voltage sources, Power & Energy in such circuits. Mesh & nodal analysis, Star Delta transformation & circuits.

Unit – II :

1- phase AC Circuits: Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity , Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power, analysis of R-L, R-C, R-L-C series & parallel circuit

3-phase AC Circuits: Necessity and advantages of three phase systems, Meaning of Phase sequence, balanced and unbalanced supply and loads. Relationship between line and phase values for balanced star and delta connections. Power in balanced & unbalanced three-phase system and their measurements

Unit – III : Magnetic Circuits: Basic definitions, magnetization characteristics of Ferro magnetic materials, self inductance and mutual inductance, energy in linear magnetic systems, coils connected in series, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F.

Single phase transformer- General construction, working principle, e.m.f. equation, equivalent circuits, phasor diagram, voltage regulation, losses and efficiency, open circuit and short circuit test

Unit IV:

Electrical Machines: Construction, Classification & Working Principle of DC machine, induction machine and synchronous machine. Working principle of 3-Phase induction motor, Concept of slip in 3- Phase induction motor, Explanation of Torque-slip characteristics of 3-Phase induction motor. Types of losses occurring in electrical machines. Applications of DC machine, induction machine and synchronous machine.

Unit V :

Basic Electronics: Number systems & Their conversion used in digital electronics, De morgan's theorem, Logic Gates, half and full adder circuits, R-S flip flop, J-K flip flop. Introduction to Semiconductors, Diodes, V-I characteristics, Bipolar junction transistors (BJT) and their working, introduction to CC, CB & CE transistor configurations, different configurations and modes of operation of BJT

Course outcomes:

The final outcome of the subject will result into an enhancement in understanding the basic concepts of Core Electrical Engineering subjects. The topics covered under this subject will help to enhance the basic understanding of Electrical machines and power systems and basic electronics.

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Determination of equivalent circuit parameters of a single phase transformer by O.C. and S.C. tests and estimation of voltage regulation and efficiency at various loading conditions and

verification by load test.

- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Study of V-I Characteristics of Diodes.
- Applications of Diodes and their verification.
- Transistor applications as amplifier and switch.
- Verification of truth table for various gates, Flip-Flops.
- Realizations of Various gates, Flip-Flops etc.
- Verification of De morgan's theorems.

References

1. D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, latest edition.
2. S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
3. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014
4. M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and electronics engineering, Oxford University press,2012
5. C.L. Wadhwa, Basic Electrical Engineering. New Age International.
6. B.L. Theraja & A.K Theraja Textbook of Electrical Technology - Vol. 1, S. Chand Publication
7. E. Hughes & I.M. Smith Hughes Electrical Technology Pearson
8. Vincent Del Toro Electrical Engineering Fundamentals

Engineering Graphics

Course Objective:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Contents:

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering, Principles of Orthographic Projections- Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids;

Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]

Module 7: Customisation & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Goals & Outcomes:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

Workshop Practice:

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics**(8 hours)**
5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic moulding & Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

Engineering Physics

Course Contents:

Module 1: Wave nature of particles and the Schrodinger equation (8 lectures)

Introduction to Quantum mechanics, Wave nature of Particles, operators ,Time-dependent and time-independent Schrodinger equation for wavefunction, Application: Particle in a One dimensional Box, Born interpretation, Free-particle wavefunction and wave-packets, v_g and v_p relation Uncertainty principle.

Module 2: Wave optics (8 lectures)

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer.

Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Module 3: Introduction to solids (8 lectures)

Free electron theory of metals, Fermi level of Intrinsic and extrinsic, density of states, Bloch's theorem for particles in a periodic potential, Kronig-Penney model(no derivation) and origin of energy bands. V-I characteristics of PN junction, Zener diode, Solar Cell, Hall Effec .

Module 4: Lasers (8 lectures)

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers(ruby, Neodymium),Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine. Introduction to Optical fiber, acceptance angle and cone, Numerical aperture, V number, attenuation.

Module 5: Electrostatics in vacuum (8 lectures)

Calculation of electric field and electrostatic potential for a charge distribution; Electric displacement, Basic Introduction to Dielectrics, Gradient, Divergence and curl,Stokes' theorem, Gauss Theorem, Continuity equation for current densities; Maxwell's equation in vacuum and non-conducting medium; Poynting vector.

List of Experiment

1. To determine the dispersive power of prism.
2. To determine the λ of sodium light with the help of newton's Ring.
3. Resolving Power of Telescope.
4. YDSE (Young's double slit Experiment).
5. To determine the frequency of AC mains supply.
6. V-I Characteristics of P-N junction diode.
7. To determine the λ of diode loses by single slit diffraction.
8. To determine the plank's constant with the help of photocell.
9. Hall's effect experiment.
10. Calibration of ammeter by using reference zener diode.

11. To study the effect of temperature on reverse saturation current in P-N junction diode and to determine the energy band gap.
12. To determine the λ of sodium by using plane diffraction grating.
13. To determine the prominent lines of mercury source by plane diffraction grating.
14. To determine the numerical aperture of an optical fiber.
15. To determine λ of given laser by plane diffraction grating.

Suggested Reference Books

1. A. Ghatak, Optics.
2. O. Svelto, Principles of Lasers.
3. David Griffiths, Introduction to Electrodynamics.
4. D.J. Griffiths, Quantum Mechanics.
5. Halliday & Resnick, Physics.

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

	ENERGY, ENVIRONMENT, ECOLOGY & SOCIETY

UNIT-1

Sources of Energy : Renewable & Non Renewable, Fossil fuel, Biomass Geothermal, Hydrogen, Solar, Wind, hydro, nuclear sources.

UNIT-2

Segments of Environment: Atmosphere, hydrosphere, Lithosphere, biosphere. Cycles in Ecosystem – Water, Carbon, Nitrogen. Biodiversity: Threats and conservation

UNIT-3

Air Pollution: Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Green house effect, ozone layer depletion, acid Rain. Sound Pollution: Causes, controlling measures, measurement of sound pollution (deciblage), Industrial and non – industrial.

UNIT-4

Water Pollution– Water Pollution: Pollutants in water, adverse effects. Treatment of Domestic & Industrial water effluent. Soil Pollution – Soil Profile, Pollutants in soil, their adverse effects, controlling measures.

UNIT-5

Society, Ethics & Human values– Impact of waste on society. Solid waste management Nuclear, Thermal, Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, objectives of ethics and its study . Preliminary studies regarding Environmental Protection Acts , introduction to value education, self exploration, sanyam & swasthya.

References:-

1. Harris, CE, Prichard MS, Rabin's MJ, "Engineering Ethics"; Cengage Pub.
2. Rana SVS ; "Essentials of Ecology and Environment"; PHI Pub.
3. Raynold, GW "Ethics in information Technology"; Cengage.
4. Svakumar; Energy Environment & Ethics in society; TMH
5. AK De "Environmental Chemistry"; New Age Int. Publ.
6. BK Sharma, "Environmental Chemistry" ; Goel Publ. House.
7. Bala Krishnamoorthy; "Environmental management"; PHI
8. Gerard Kiely, "Environmental Engineering" ; TMH
9. Miller GT JR; living in the Environment Thomson/cengage
10. Cunninghan WP and MA; principles of Environment Sc; TMH
11. Gandhiji M.K.- My experiments with truth

Basic Mechanical Engineering

Course Contents:

Unit I :

Materials : Classification of engineering material, Composition of Cast iron and Carbon steels, Iron Carbon diagram. Alloy steels their applications. Mechanical properties like strength, hardness, toughness , ductility, brittleness , malleability etc. of materials , Tensile test- Stress-strain diagram of ductile and brittle materials ,Hooks law and modulus of elasticity, Hardness and Impact testing of materials, BHN etc.

Unit II:

Measurement: Concept of measurements, errors in measurement, Temperature, Pressure, Velocity, Flow strain, Force and torque measurement, Vernier caliper, Micrometer, Dial gauge, Slip gauge, Sine-bar and Combination set.

Production Engineering: Elementary theoretical aspects of production processes like casting, carpentry, welding etc Introduction to Lathe and Drilling machines and their various operations.

Unit III :

Fluids : Fluid properties pressure, density and viscosity etc. Types of fluids , Newton's law of viscosity , Pascal's law , Bernoulli's equation for incompressible fluids, Only working principle of Hydraulic machines, pumps, turbines, Reciprocating pumps .

Unit IV:

Thermodynamics : Thermodynamic system, properties, state, process, Zeroth, First and second law of thermodynamics, thermodynamic processes at constant pressure, volume, enthalpy & entropy.

Steam Engineering : Classification and working of boilers, mountings and accessories of boilers, Efficiency and performance analysis, natural and artificial draught, steam properties, use of steam tables.

Unit V:

Reciprocating Machines :

Working principle of steam Engine, Carnot, Otto, Diesel and Dual cycles P-V & T-S diagrams and its efficiency, working of Two stroke & Four stroke Petrol & Diesel engines. Working principle of compressor.

Reference Books:

1- Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age .
2- Nakra & Chaudhary , Instrumentation and Measurements, TMH.
3- Nag P.K, Engineering Thermodynamics , TMH .
4- Ganesan , Internal Combustion Engines, TMH .
5- Agrawal C M, Basic Mechanical Engineering ,Wiley Publication.
6- Achuthan M , , Engineering Thermodynamics ,PHI.

List of Suggestive Core Experiments:

Theory related Eight to Ten experiments including core experiments as follows:

1- Study of Universal Testing machines.
2- Linear and Angular measurement using, Micrometer, Slip Gauges, Dial Gauge and Sine-bar.
3- Study of Lathe Machine.
4- Study of Drilling Machines.
5- Verification of Bernoulli's Theorem.
6- Study of various types of Boilers.
7- Study of different IC Engines.
8- Study of different types of Boilers Mountings and accessories.

Basic Civil Engineering & Engg. Mechanics

Course Contents:

Unit I Building Materials & Construction

Stones, bricks, cement, lime, timber-types, properties, test & uses, laboratory tests concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, compaction, curing.

Elements of Building Construction, Foundations conventional spread footings, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases – types and their suitability

Unit II Surveying & Positioning:

Introduction to surveying Instruments – levels, thedolites, plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by different methods. Reciprocal leveling.

Unit III Mapping & sensing:

Mapping details and contouring, Profile Cross sectioning and measurement of areas, volumes, application of measurements in quantity computations, Survey stations, Introduction of remote sensing and its applications.

Engineering Mechanics

Unit IV

Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent Co- planner forces, free Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses: Method of joints, Method of Sections. Frictional force in equilibrium problems

Unit – V

Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment Inertia of Area and Mass, Radius of Gyration, Introduction to product of Inertia and Principle Axes.

Support Reactions, Shear force and bending moment Diagram for Cantilever & simply supported beam with concentrated, distributed load and Couple.

Reference Books:

1. S. Ramamrutam & R.Narayanan; Basic Civil Engineering, Dhanpat Rai Pub.
2. Prasad I.B., Applied Mechanics, Khanna Publication.
3. Punmia, B.C., Surveying, Standard book depot.
4. Shesha Prakash and Mogaveer; Elements of Civil Engg & Engg. Mechanics; PHI
5. S.P,Timoshenko, Mechanics of stricture, East West press Pvt.Ltd.
6. Surveying by Duggal – Tata McGraw Hill New Delhi.
7. Building Construction by S.C. Rangwala- Charotar publications House, Anand.
8. Building Construction by Grucharan Singh- Standard Book House, New Delhi
9. Global Positioning System Principles and application- Gopi, TMH
10. R.C. Hibbler – Engineering Mechanics: Statics & Dynamics.
11. A. Boresi & Schmidt- Engineering Mechines- statics dynamics, Thomson' Books
12. R.K. Rajput, Engineering Mechanics S.Chand & Co.

List of suggestive core Experiments:

Students are expected to perform minimum ten experiments from the list suggested below by preferably selecting experiments from each unit of syllabus.

1. To perform traverse surveying with prismatic compass, check for local attraction and determine corrected bearings and to balance the traverse by Bowditch's rule.
2. To perform leveling exercise by height of instrument of Rise and fall method.
3. To measure horizontal and vertical angles in the field by using Theodolite.
4. To determine (a) normal consistency (b) Initial and Final Setting time of a cement Sample.
5. To determine the workability of fresh concrete of given proportions by slump test or compaction factor test.
6. To determine the Compressive Strength of brick.
7. To determine particle size distribution and fineness modulus of course and fine Aggregate.
8. To verify the law of Triangle of forces and Lami's theorem.
9. To verify the law of parallelogram of forces.
10. To verify law of polygon of forces
11. To find the support reactions of a given truss and verify analytically.
12. To determine support reaction and shear force at a given section of a simply Supported beam and verify in analytically using parallel beam apparatus.
13. To determine the moment of inertia of fly wheel by falling weight method.
14. To verify bending moment at a given section of a simply supported beam.

Basic Computer Engineering

Course Contents:

UNIT I

Computer: Definition, Classification, Organization i.e. CPU, register, Bus architecture, Instruction set, Memory & Storage Systems, I/O Devices, and System & Application Software. Computer Application in e-Business, Bio-Informatics, health Care, Remote Sensing & GIS, Meteorology and Climatology, Computer Gaming, Multimedia and Animation etc.

Operating System: Definition, Function, Types, Management of File, Process & Memory. Introdcution to MS word, MS powerpoint, MS Excel

UNIT II

Introduction to Algorithms, Complexities and Flowchart, Introduction to Programming, Categories of Programming Languages, Program Design, Programming Paradigms, Characteristics or Concepts of OOP, Procedure Oriented Programming VS object oriented Programming. Introduction to C++: Character Set, Tokens, Precedence and Associativity, Program Structure, Data Types, Variables, Operators, Expressions, Statements and control structures, I/O operations, Array, Functions,

UNIT III

Object & Classes, Scope Resolution Operator, Constructors & Destructors, Friend Functions, Inheritance, Polymorphism, Overloading Functions & Operators, Types of Inheritance, Virtual functions. Introduction to Data Structures.

UNIT IV

Computer Networking: Introduction, Goals, ISO-OSI Model, Functions of Different Layers. Internetworking Concepts, Devices, TCP/IP Model. Introduction to Internet, World Wide Web, E-commerce

Computer Security Basics: Introduction to viruses, worms, malware, Trojans, Spyware and Anti-Spyware Software, Different types of attacks like Money Laundering, Information Theft, Cyber Pornography, Email spoofing, Denial of Service (DoS), Cyber Stalking, ,Logic bombs, Hacking Spamming, Cyber Defamation , pharming Security measures Firewall, Computer Ethics & Good Practices, Introduction of Cyber Laws about Internet Fraud, Good Computer Security Habits,

UNIT V

Data base Management System: Introduction, File oriented approach and Database approach, Data Models, Architecture of Database System, Data independence, Data dictionary, DBA, Primary Key, Data definition language and Manipulation Languages.

Cloud computing: definition, cloud infrastructure, cloud segments or service delivery models (IaaS, PaaS and SaaS), cloud deployment models/ types of cloud (public, private, community and hybrid clouds), Pros and Cons of cloud computing

List of Experiment

01. Study and practice of Internal & External DOS commands.
02. Study and practice of Basic linux Commands – ls, cp, mv, rm, chmod, kill, ps etc.
03. Study and Practice of MS windows – Folder related operations, My-Computer, window explorer, Control Panel,
04. Creation and editing of Text files using MS- word.
05. Creation and operating of spreadsheet using MS-Excel.
06. Creation and editing power-point slides using MS- power point
07. Creation and manipulation of database table using SQL in MS-Access.
08. WAP to illustrate Arithmetic expressions
09. WAP to illustrate Arrays.
10. WAP to illustrate functions.
11. WAP to illustrate constructor & Destructor
12. WAP to illustrate Object and classes.

13. WAP to illustrate Operator overloading
14. WAP to illustrate Function overloading
15. WAP to illustrate Derived classes & Inheritance
16. WAP to insert and delete and element from the Stack
17. WAP to insert and delete and element from the Queue
18. WAP to insert and delete and element from the Linked List

Recommended Text Books:

1. Fundamentals of Computers : E Balagurusamy, TMH
2. Basic Computer Engineering: Silakari and Shukla, Wiley India
3. Fundamentals of Computers : V Rajaraman, PHI
4. Information Technology Principles and Application: Ajoy Kumar Ray & Tinku Acharya PHI.

Recommended Reference Books:

1. Introduction of Computers : Peter Norton, TMH
2. Object Oriented Programming with C++ :E.Balagurusamy, TMH
3. Object Oriented Programming in C++: Rajesh K.Shukla, Wiley India
4. Concepts in Computing: Kenneth Hoganson, Jones & Bartlett.
5. Operating Systems – Silberschatz and Galvin - Wiley India
6. Computer Networks:Andrew Tananbaum, PHI
7. Data Base Management Systems, Korth, TMH
8. Cloud Computing, Kumar, Wiley India

Language Lab and Seminars

Course objective: This course intends to impart practical training in the use of English Language for Communicative purposes and aims to develop students' personality through language Laboratory.

Topics to be covered in the Language laboratory sessions:

1. Introducing oneself, family, social roles.
2. Public Speaking and oral skills with emphasis on conversational practice, extempore speech, JAM(Just a minute sessions), describing objects and situations, giving directions, debate, telephonic etiquette.
3. Reading Comprehension: Intensive reading skills, rapid reading, and reading aloud (Reading material to be selected by the teacher).
4. To write a book review. Standard text must be selected by the teacher.
5. Role plays: preparation and delivery topic to be selected by teacher/faculty.

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MATHEMATICS II

Unit I

Fourier Series: Introduction of Fourier series , Fourier series for Discontinuous functions, Fourier series for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier transform, Sine and Cosine transform.

Unit II

Laplace Transform: Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations

Unit III

Second Order linear differential equation with variable coefficients : Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series Method

Unit IV

Linear and Non Linear partial differential equation of first order: Formulation of partial differential equations, solution of equation by direct integration, Lagrange's Linear equation, charpit's method. Linear partial differential equation of second and higher order: Linear homogeneous and Non homogeneous partial diff. equation of nth order with constant coefficients. Separation of variable method for the solution of wave and heat equations

Unit V

Vector Calculus: Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green's, Stoke's and Gauss divergence theorem

References

(i) Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India
(ii) Higher Engineering Mathematics by BS Grewal, Khanna Publication
(iii) Advance Engineering Mathematics by D.G.Guffy
(iv) Mathematics for Engineers by S.Arumungam, SCITECH Publuication
(v) Engineering Mathematics by S S Sastri. P.H.I.

INTRODUCTION TO MINING

UNIT 1:
Exploratory Drilling, Drilling machines used for exploratory drilling viz. Rotary & Percussive, their attachments; Core Barrels; Conditions of applicability of drilling methods; Borehole Survey, Directional drilling, Underground methods of exploratory drilling.

UNIT 2:
Drivage of Inclines/Drifts/Adits Types of Openings; Choice of Openings; Location of Openings; Drilling, blasting, loading and transportation of muck during drivage of inclines/adits/drifts, Ventilation, lighting and drainage, Extension of center line; Organization and cycle of operations; Mechanized methods of drivages of inclines/adits/drifts.

UNIT 3:
Shaft Sinking Drilling, blasting, loading and transportation of muck, Ventilation, lighting and drainage, Extension of center line; Shaft lining and its design; Special methods of shaft sinking; Shaft boring; Deepening and widening of shafts. Upward drivages of shaft.

UNIT 4:
Introduction to Underground Mining Definition of important terms, Mine development, Activities involved in development of a mine, Stages in the life of a mine, Introduction to unit operations in underground mining. Choice of method of mining, Introduction to various Underground Mining methods Introduction to various types of machineries used in Underground mining.

UNIT 5:
Introduction to surface Mining Definition of important terms, Advantages and disadvantages of surface mining, mineral deposits amenable to surface mining, Various surface mining methods, Introduction to unit operations in surface mining. Introduction to various types of machineries used in surface mining.

RECOMMENDED BOOKS:

1. Surface Mining : G.B. Mishra
2. Mining Engineer's Handbook Vol. 1&2, 2nd Edition : Edited by Harold Hartman
3. Elements of Mining Technology Vol. 1&3: D.J.Deshmukh
4. Mining of Mineral Deposits: Shevyakov
5. Modern Coal Mining: Samir Das
6. Coal Mining: R.D.Singh
7. Mining: Boki

Basic Electrical Engineering

UNIT- I POLYPHASE CIRCUITS: Power measurement by single and two wattmeter methods, power factor correction by simple methods, star and delta networks, D.C. two wire & three wire system, A.C. three wire & four wire system. Types of cables, Underground distribution schemes, Electrical Signaling in mines.

UNIT-II TRANSFORMERS: Construction, principle of operation, equivalent circuits, phasor diagram, regulation and losses and efficiency, Open circuit and short circuit tests. Auto transformers and introduction to three phase transformers.

UNIT- III D.C. MACHINES: Construction, principle of operation and characteristics of D.C. Generators, losses and efficiency, Types of D.C. Motors and their characteristics, starters, speed control and industrial applications. Choice of motors for specific and based on characteristics of loads and motors.

UNIT-IV A.C. MACHINES: General principles and construction of alternators, induction motors and synchronous motors, induction motors types, equivalent circuits, torque slip characteristics, starting and speed control, synchronous condenser, use of synchronous and induction motors for rope haulage, locomotive, conveyors, winders, pumps, fan compressors etc, Electric Braking – types, sequence control, various motors enclosures.

UNIT-V TRANSMISSION AND DISTRIBUTORS OF POWERS IN MINES: D.C. two wire and three wire system, A.C. three wire and four wire system, Types of cable, Underground distribution schemes, Electrical signaling in Mines. Switch Gear and Protection: Elementary idea of air bread, switches, air bread and oil break, circuit breakers, over current, earth fault protection, intrinsically safe apparatus, simplified connection diagram A.C. switch board. Switch gear for coal face machinery

Text Books:

1. Electrical equipment in Mines by H.Cotton .

2. Electrical Machines by Smarajit Ghosh, Pearson Education

3. Performance & Design of A.C. Machines by M.G. Say, C.B.S. Publishers

Reference Books: 1. Performance & Design of D.C. Machines by A.E. Clayton & Hancock, C.B.S. Pbs.

2. Electric Machines by Nagrath & Kothari, TMH Pbs.

3.Electrical Technology – S.L.Uppal, Khanna Publication
4. ELectrical Measurement – J.B. Gupta, Dhanpat Rai & So

List of experiments:

1. Verification of Kirchhoff's Law
2. To Measure Voltage Current and power in single phase AC circuit.
3. To calculate Impedance, power and power factor by measuring voltage across each element and current to the circuit for a given RLC series circuit.
4. Study of different parts of DC machine.
5. Study of three point starter for DC motor.
6. To determine transformation ratio of a given single phase transformer.
7. Study and operation of DOL and Star Delta Starter.
8. to measure slip for a given three phase induction motor.
9. To measure insulation resistance by Megger.
10To measure earth resistance by earth tester

MINING GEOLOGY – I

UNIT 1:
The Earth in Space and Time
Solar System; Size, Shape, Mass and Density of Earth; A Brief idea of the origin and the age of the Earth; Interior of the Earth-seismic data, Density and Pressure within the Earth; The internal structure and composition of Earth;; Elementary knowledge of Diastrophism, earthquakes and volcanism, Volcanic and earthquake belts, and their relationship with plate tectonics.

UNIT 2:
Mineralogy
Physical Properties of Minerals; Classification of various Rock forming Minerals; Introduction and preliminary study of principle Rock forming Mineral groups - Garnet, Pyroxene, Amphibole, Mica, Feldspar and Felspethoid, Megascopic properties of Economically important non-Silicate minerals.

UNIT 3:
Igneous and Metamorphic Petrology
Elementary knowledge of Magma and its Crystallization; Classification of Igneous Rocks; Textures and Structures of Igneous Rocks; Petro graphic Description of Common Igneous Rocks; Agents and Types of Metamorphism; Depth zones, Facies and Grades of Metamorphism and Petro graphic Description of Common Metamorphic Rocks

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UNIT 4:
Sedimentary Petrology
Textures and Structures of Sedimentary Rocks; Sedimentary Processes-Weathering, Transportation and Deposition; Classification and Petro graphic Description of Common Sedimentary Rocks.

UNIT 5:
Structural Geology
Concept of Deformation; Primary and Secondary Planer and Linear structure of Rocks; Topography and its representations; Altitude of strata- Dip and strike; Outcrop patterns; Width of Outcrop and thickness of beds; Structural Contours; Geological Maps; Study of Unconformity; Folds, Joints, Faults and their influence in Mining Operations.

RECOMMENDED BOOKS:

a. Engineering And General Geology : Parbin Singh
b. Physical And Engineering Geology : S.K. Garg
c. Rutley's Elements of Mineralogy : H.H.Read
d. Principles Of Petrology : G.W.Tyrell
e. Structural Geology : M.P.Billings
f. Geological Maps : G.W.Chiplonkar
g. A Text Book of Geology : P.K. Mukherjee
h. Applied Geology : S. Banger

List of Experiment (Expandable):-

1. Megascopic Description of Rock Forming Minerals.
2. Megascopic Description of important Igneous, Sedimentary, Metamorphic Rocks.
3. Basic Concept of Contours, Attitude of Beds, Width of Outcrop, True and Apparent Dips.
4. Study of Geological Maps and Preparation of Cross Sections.

MINING SURVEYING – I

UNIT 1: Chain Survey
Linear Measurements; Types of chains; Tapes; Errors in chaining and corrections in linear measurements; Direct and indirect Ranging; Principles of chain surveying offsets Limiting length of offsets; Booking field notes; Obstacles in chaining; Instruments for setting out right angles.

UNIT 2: Compass Survey
Theory of Magnetism; Dip of Magnetic needle; Prismatic Compass; Surveyor's Compass; Bearings; Designation of Bearings; Calculation of Included Angles; Local Attraction; Magnetic Declination.

UNIT 3: Plane Table Surveying
Principles of Plane Tabling; Working operations; Methods of Plane Table Surveying; Two and Three point problems.

UNIT 4: Dial Surveying
Construction; Use; Tests and Adjustments; Loose and fast Needle surveying; Common Sources of errors in Dial surveying; Methods of elimination and compensation.

UNIT 5: Leveling
Definitions of important terms used in leveling; Development in leveling Instruments; Types and Constructional details; Temporary and Permanent Adjustments; Methods of leveling; Straight edge leveling; Fly leveling; Check leveling; Reciprocal leveling; Longitudinal Sections; Cross- Sectioning; Trigonometric leveling; Methods of booking and reduction of levels; Leveling through drifts and shafts (Including steeply inclined shafts) ; Plumbing measurements of depth of shaft and subsidence.

Text Book:
1. Metalliferous Mine Surveying: Frederick Winniberg
2. Surveying and levelling: Kanetkar and Deshpande

References:
a. Surveying Vol. I by B.C. Pun/mia& Ashok Jain
b. Suverying Vol. II by B.C.Punmia& Ashok Jain
c. Surveying Vol. I by S.K.Duggal
d. Surveying Vol II by S.K.Duggal

List of Experiment:-

Experiment 1.
(a) Ranging a line.
(c) Chaining a line and recording in the field book.
(d) Testing and adjustment of chain.

Experiment 2.
(a) Chaining of a line involving reciprocal ranging
(b) Taking offsets and setting out right angels with cross staff and Indian optical square.

Experiment 3. Chain survey of a small area.

Experiment 4. Chaining a line involving obstacles in ranging.

Experiment 5.
(a) Setting the compass and taking observations.
(b) Measuring angle between the lines meeting at a point by prismatic compass.

Experiment 6
Traversing with the prismatic compass and chain of a closed traverse. (Recording and plotting by included angles).

Experiment 7 Traversing with the prismatic compass and chain of a closed and open traverse. (Recording and Plotting by deflection angles).

Experiment 8
Determination of local traction at a station by taking fore and back bearing.

Experiment 9
To find true bearing of a line at a place.

Experiment 10
To find difference of level between two distant points by taking staff reading on different
Stations from the single setting.
Experiment 11 to find difference of level between two points by taking at least four change points.
Experiment 12. Longitudinal sectioning of a road.

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SEMINAR / GROUP DISCUSSION (INTERNAL ASSESSMENT)

Objective of GD and seminar is to improve the MASS COMMUNICATION and CONVINCING/Understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves.

Evaluation will be done by assigned faculty based on group discussion and power point Presentation.

Mechanics of Solids & Fluid

UNIT- I

Concept of Stress and Strain

Stress and strain at a point; Axial and shear stresses' Ultimate an working stresses; Relation between stress and strain' Poisson's Ratio; Two dimensional state of strain' Principle stresses and Principle planes' Mohr's Circle 'Two state of strain' Principle strains and principle axis of strain; Determination of Principle strain from strain measurements; Calculation of Principle stresses from; Principle strains; Composite bars in tension and compassion; Thermal stresses in composite bars.

UNIT II

Bending Stresses in Beams and plates Pure bending' Bending Stresses' Section Modulus of rolled and built up sections Composite beams' Distribution of normal and shear stresses across the section of a simple beam with vertical section of symmetry; Theory of plates.

UNIT III

Slope and deflection of beams Deflection of beams by deflection methods; Area moment and conjugate beam methods 'propped cantilever and fixed beams.

UNIT IV

Introduction to Fluid Mechanics- Physical properties of fluids; Compressible and Incompressible fluids; Newtonian and Non-Newtonian fluids.

Fluid Statics - Pressure, density and height relationships; manometer pressure on curved and plane surfaces; Centre of Pressure; Buoyancy; Stability of Immersed and Floating bodies; Fluids in relative equilibrium

UNIT V

Fluid Kinematics -Classification of flow: Uniform and Non-Uniform; Steady and Non- Steady; Laminar and Turbulent; One, Two, Three dimensional flows; Stream lines; Streak lines; Path lines; Stream Tubes; Elementary Explanation of stream function and velocity potential; Basic idea of flow nets.

RECOMMENDED BOOKS:

Strength of Material – Dr. Sadhu Singh – Khanna Publishers
Elements of Strength of Material – Timo Shenko & Young – EWP Press
Strength of Material – R.K. Rajput – Dhanpat Rai & Sons
Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications

Underground Coal Mining

UNIT: 1

INTRODUCTION: Origin Of Coal, Theories Of Coal Formation, Classification Of Coal, Coaking Coal, Coal Seam and its Classification, Coal Seam Structures and Abnormalities like Faults, Joints, Cleats, Folds etc., Coal Measuring Rocks and Their Characteristics, Distribution Of Coal in India, Indian Coal Mining Industry; Choice Of Coal Mining Methods.

UNIT: 2

BOARD AND PILLAR METHOD: Important Terminology, Development Size and Shape Of The Pillar, Galleries, Panel System and Without Panel System Of Development, Size Of Panel, Cycle Of Operation, Depillaring, Problems in Depillaring, Preparatory Arrangements, Depillaring by Stowing, Depillaring by Caving Methods, Pillar Extraction Techniques, Dangers Associated With Depillaring

UNIT: 3

LONGWALL MINING: Important Terminology, Types Of Longwall Faces and Their Choice, Merits and Demerits Of Longwall Mining, Development Of Longwall Panels and Faces, Longwall Advancing Method, Longwall Retreating Method, Length Of Longwall Faces, Rate Of Face Advance, Double Unit Longwall Faces, Face Organization and Material Supply.

UNIT: 4

THICK SEAM MINING: Problem in Mining Of Thick Seams, Choice Of Thick Seam Mining Methods, Inclined Slicing, Horizontal Slicing, Diagonal Slicing, Transverse Slicing, Sublevel Caving, Blasting Gallery Method, Cable-Bolting Method Of Thick Seam Extraction

UNIT: 5

ROOM AND PILLAR MINING: Vermelles Method, Slant Method, Sublevel Method, Coal Saw Method, Mining Of Contiguous Seams, Mining Of Steeply Inclined Seam, Mining Under Water, Mining of Seams Prone to Spontaneous Heating, Bumps, Air Blast etc.

RECOMMENDED BOOKS:

Text Books:
1. Elements of Mining Technology (Vol. 1 & 3): D. J. Deshmukh
2. Coal Mining: R.D.Singh
3. Modern Coal Mining: Samir Das

Reference Books:
1. Mining Engineer's Handbook (Vol. 1&2), 2nd Edition: Edited by Harold Hartman
2. Introduction to mining: Hartman

Laboratory
List of Experiments:
1. Study of layouts of Board and Pillar development working by without panel system.
2. Study of layouts of Board and Pillar development working by panel system.
3. Study of layout of Longwall Advancing system.
4. Study of layout of Longwall Retreating system.
5. Study of various line of extraction used for pillar extraction.
6. Study of stook extraction method under difficult roof conditions.
7. Study of surface arrangement required for stowing.
8. Study of sublevel caving method of thick seam mining.
9. Study of layout of blasting gallery method.
10. Study of layout of Double Unit Longwall Faces.

Engineering Materials

UNIT 1 General: Introduction, Classification of Engg. Materials, Structure of Metals and Alloys, Iron-carbon phase diagram.

UNIT 2: Treatment of Iron & Steel: Different Types Of Steels, Their Properties and Uses, Different Types Of Heat Treatment Techniques viz. Hardening, Annealing, Normalizing & Tempering and Their Uses in Mining Industry

UNIT 3: Wire Rope: Types and Construction, Wire Rope Lays, Non- Stranded Ropes, Selection Of Wire Ropes, Ropes Used For Different Purpose, Mass & Strength Of Wire Ropes.

UNIT 4: Construction Materials: Cements – Classification & Properties, Quick Setting Cement, R.C.C., Shot creating, Brick & Stone Masonries, and Application of Fly Ash in Mining.

UNIT 5: Engineering Behavior of Some Materials: stress-strain Curves Of typical Engg. Materials, Elastic and Plastic Deformation, Fracture, Fatigue and Creep.

RECOMMENDED BOOKS:

1. Engineering Physical Metallurgy – Lakhtin – CBS Publishers & Distributors
2. D. J. Deshmukh, Elements of mining technology, Vol. 3, Vidyasewa, 3rd ed, 1989.
3. A Text Book of Material Science & Metallurgy – O.P. Khanna – Dhanpat Rai & Sons

MINING GEOLOGY –II

UNIT 1:
Stratigraphy Introduction, Definitions and Basic Principles Of Stratigraphy; Units of Stratigraphy; Criteria for Stratigraphic Classification and Correlation; Standard Geological Time Scale; Fossils-Elementary Idea about Their Conditions, Modes of Their Preservation and Their Uses; Broad Paleontological Groups of Animals and Plants; Brief Paleontological Study of Gondwana Fields.

UNIT 2:
Indian Geology Major Geomorphic Divisions of India; General Review of Indian Stratigraphy; Descriptions of important Indian Geological formations – Archeans ,Cuddapahs , Vindhyans , Gondwanas and teriaries.

UNIT 3:
Economic Geology-I Introduction and Scope of the subject; Fundamental Terms and Their Definitions; Distribution and Morphology of Minerals Deposits; Brief Review of the Processes of Mineral Formation and the Genetic classification of mineral deposits.

UNIT 4:
Economic Geology-II Mode Of Occurrence, Origin, Distribution, Association and Industrial Uses of Important Metallic (Au, Al,Cu, Fe, Mn, Sn, Pb And Zn) and Non-Metallic (Diamond, Mica, Radioactive Minerals, Gypsum, Dolomites. Fire-Clay, Magnesite, Talc, Asbestos, Graphite, Kyanite, Sillimanite, Corundum, Fluorite, Phosphorite, precious and semi-precious stones, minerals, petroleum deposits of India.

UNIT 5:
Prospecting and Exploration Prospecting and Exploration -Their Definitions and Classification Of Methods; Elementary Methods Of Geological, Geophysical, Geochemical Prospecting; Guides To Ores- Ringed Targets, Intersection Loci, Physiographical, Mineralogical, Stratigraphical and Structural Guides To Ores.

RECOMMENDED BOOKS:

1. Fundamentals of Historical Geology and Stratigraphy of India: Ravindra Kumar
2. Geology of India and Burma: M.S. Krishnan 3. Economic Mineral Deposit :M.L.Jensen & A. Batman
3. Fundamentals of Historical Geology and Stratigraphy of India: Ravindra Kumar
4. Geology Of India and Burma :M.S. Krishnan 3. Economic Mineral Deposit :M.L.Jensen&A.Batman
5. India's Mineral Resources :S. Krishnaswamy
6. Geophysical Prospecting :M.Dorbin& B. Mille

7. **Mining Geology -II Lab.**

A. Megascopic Description and Distribution of Ore Forming Minerals and Industrial Minerals.
B. Study of Plant Fossils.
C. Study of Advance Geological Maps and Preparation of Cross Sections

MINING MACHINERY –I

UNIT 1:
Arial ropeways Different types, their constructions & installation, operation & maintenance, design calculation, their layout including rope-tensioning arrangements.

UNIT 2:
Conveyors Different types of belt conveyors, their construction, installation, maintenance & design calculations.

UNIT 3:
Shaker conveyor, scraper chain conveyor and armored chain conveyor, their installation &construction maintenance. Safety Devices; Pit top and pit bottom arrangements.

UNIT 4:
Skip & Koepe Winding Skip types & Construction, pit top & pit bottom arrangements, advantages and disadvantages Types of rope Winder, Koepe wheel, floating platforms, two winders working in the same shaft, winding with side by side and up and down sheaves, advantages and disadvantages. Multi rope winding. Calculation of H.P

UNIT 5:
Hydraulic transmissions Fundamental of hydrostatic compression, hydraulic fluids, hydraulic pumps, motors, cylinders and accumulators, different types of valves, hydraulic coupling and torque converters, Application in mines, Advantages of hydraulic transmission.

RECOMMENDED BOOKS:

1. Elements of Mining Tech. Vol I &Vol III by D. J. Deshmukh
2. Mining Machinery By S. C. Walker 3. Coal Mining Practice By Stathum

List of Experiments to be performed:

1. Study of Monocable aerial Ropeway.
2. Study of Bicable aerial Ropeway.
3. Study of Loop take-up and tensioning arrangement of a belt conveyor.
4. Study of pit top and pit bottom arrangements for a belt conveyor.
5. Study of Belt Conveyor
6. Study of an Armoured face Conveyor.
7. Study of Various Koepe Arrangements
8. Study of various types of skips.
9. Study of pit top and pit bottom arrangements for a Skip.
10. Study of hydraulic Couplings and Torque Converters.

TOUR REPORT & VIVA-VOCE

Course Objective:
Whatever may be the research and developments in Rock Mechanics, the behaviour of rock is less predictable accurately. Mining Engineering is hence said to be an art more than engineering and the knowledge gained through experience is more valuable.

Instructional Objective:
The training enables the students to experience with the practical applications of the theoretical learning. The outcome at the place of work is always much more than what can be learned in the class room.

Teaching Scheme:
The industrial training phase I will be organized during summer vacation after IV semester examinations for a minimum duration of four weeks. The class shall be divided into batches of 4 or 5 students and sent to pre-determined mines from where the permissions are obtained. Students may camp at the mines or elsewhere and undergo training as per the direction of mine management. Notional teaching scheme: 4 hrs /week Practical for guidance of students.

Essential Contents of Tour Report:
a. Name of the mine along with names of owner, agent, manager and other senior officials.
b. Location and a brief history of the mine.
c. Brief geological description along with characteristics of the ore and its marketing scenario.
d. The surface features including mine entries, loading & transport arrangement of ore, disposal of waste, ore beneficiation.
e. Method of working including strata control in underground mines and dump management in opencast mines.
f. Sampling, survey, training and rescue sections.
g. Acknowledgements.

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

SELF STUDY (INTERNAL ASSESSMENT)

Objective of Self Study: is to induce the student to explore and read technical aspects of his Area of interest / hobby or new topics suggested by faculty.

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SEMINAR / GROUP DISCUSSION (INTERNAL ASSESSMENT)

Objective of GD and seminar is to improve the MASS COMMUNICATION and CONVINCING/ Understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves.

Evaluation will be done by assigned faculty based on group discussion and power point Presentation.

MINING MACHINERY -II

UNIT I

Winding: Shaft fittings and head gear design.

Winding System: Different types, Mechanical and electrical braking, Ward Leonard control, Automatic winding. Winding drums: Types, their construction and duty cycles, Detaching hooks, Cages, Skips and suspension gear, Rigid and rope guides, Methods of counter balancing loads, Multi rope winding, Winding from different horizons, Design calculation for different types of winding system, Safety devices, Signaling Safety regulations different signaling system in mines.

UNIT II

Mineral Handing : Layouts of pit-top and pit-bottom, Details of banking, Mineral handling and screening equipments, Creepers, Tipplers, Layouts of railways siding of mines.

UNIT III

Mechanics of Coal Cutting: Workability of Coal, Efficiency of coal cutting equipments, Design of equipments, Selection and application of machinery.

UNIT IV

Face Loaders for Coal Mines: Construction features, Principal types, Choice of loaders, Operation and maintenance, Layout of faces for working with power loaders under varied condition.

UNIT V

Cutter Loaders: Coal Ploughs and continuous Miners: Principles of operation, construction features, their suitability, their choice, operation and maintenance.

RECOMMENDED BOOKS:

1. Elements of Mining Technology (Vol- II), D.J.Deshmukh.
2. Advance coal mining Tech., Samir Kumar Das.

SURFACE MINE PRODUCTION

UNIT I

Surface Mining: General information, Basic definition, Surface mining, Quarrying strip mining, open pit mining, open cast mining, Terms: Advantages and disadvantages. Determination of main parameters, Major dimensions, Heights and widths and benches, Slop angles, Opening up of mines by surface methods, driving of ingoing trenches, Laying of communication routes, System of disposal of overburden, Removal of cover rocks, Factors influencing selection and characteristics of opencast work.

UNIT II

General surface mining method, Basis layouts, Choice of mining method. Major operations in surface mining. Ground Preparation: Bull dozing, Scrapping, Grading, and Ripping.

UNIT III

Drilling: Criteria for selection and performance of different types of drilling equipments, drilling patterns: Inclined drilling, Blasting: Explosives, Multi row blasting, Twin bench blasting: Coyote blasting, Secondary blasting, Overcastting by explosives.

UNIT IV

Excavation and Loading: Factors influencing choice of excavating and loading machines, their performance in different condition of ground, Power shovel, Dragline, BWE, BCE, Front end loaders, Backhoes, Surface miner, Transport: Comparative study of different transport system in Opencast mines, Factors influencing choice of a system, Optimization of load haul system, Dumpers, Coal haulers, Belt conveyer, Pipe line transportation.

UNIT V

Storage: Stock piling and re handling, Spreaders, Re claimers, Reclamation: Planning methods of reclamation for different types of opencast mines, Drainage: Sources of water assessment of drainage requirements drainage patterns, Slope Stability: Factors influencing stability of slopes, Mechanics of slope failures, Stability analysis, Methods of improving stability of slopes, Protection and monitoring, Influence of pit slope on mine economics.

RECOMMENDED BOOKS:

a. Elements of Mining Tech. (Vol- I), D. J. Deshmukh.
b. Surface Mining Technology, Samir Kumar Das.
c. Elements of Mining Tech. (Vol- I), D. J. Deshmukh.
d. -Surface Mining Technology, Samir Kumar Das.
e. Heavy Earth Moving Machines, Amitosh de. U M S

Mine Legislation – I

UNIT I
General Principles of Mining Law, Development of mining legislation in India

UNIT II
Mines Act – 1952 & Mines Rules – 1956

UNIT III
Coal Mines Regulations –1957 & Metalliferous Mines Regulation-1961

UNIT IV
Mine crèche Rules

UNIT V
Mine Vocational- training Rules

Text books:
1 Legislation in Indian Mines (A critical Appraisal) Vol. II & I by S. D. Prasad & Prof. Rakesh
2 CMR-1957 & MMR-1961 by L. C. Kaku.
3 Mines Act-1952 & Mines Rules-1955 by L. C. Kaku.
4 Vocational Training Rules by L. C. Kaku.
5 Mine Accidents by S. J. Kejeriwal

Mining Surveying-II

UNIT 1:
Theodolite Surveying Types of Theodolites; Description of various parts of a Vernier Theodolite; Requirements of Mining type Theodolites; Measurements of height and distances of accessible and inaccessible points; Traversing with Theodolite on surface and underground; Checks on Closed and Open traverses. Balancing of traverses; Temporary & Permanent adjustments of Theodolites; Sources of errors and their prevention.

UNIT 2:
Tacheometry Principles of Stadia Methods; Determination of constants; Theory of analectic lens; Distance and elevation formulae Subtense and Tangential Methods; Reduction of stadia Notes; Beam and stadia bar; Auto-reduction Tacheometer.

UNIT 3:
Setting Out Setting out simple curves on surface and in underground; Elementary knowledge of compound and transition curves; joint boundary survey; Equalization of boundaries; Maintenance of direction and gradient of roadways i.e. marking and checking of center line and grade line, transfer of point from roof to floor and floor to roof.

UNIT 4:
Errors & Problems Computation of areas and volumes; Earthwork calculation; Problems based on Co-ordinates, faults, Dip-Strike and boreholes; Sources, classification and relative importance of errors, their prevention and elimination, theory of errors, adjustment of errors.

UNIT 5:
Plans & Sections General requirements of mine plans; types of plans; Symbols used in mine plans; preparation of plans & sections; Plotting of traverse; Checking accuracy of old mine plans; Planimeter and its uses; Enlargement & reduction of plans. Mines Regulations concerning above topics.

RECOMMENDED BOOKS:

1. Mine surveying by S. Ghatak
2. Surveying &Levelling by B. C. Punamia
3. Surveying &Levelling by Kanetkar & Kulkarni
4. Surveying & leveling by C.L. Kocher
5. Surveying &Levelling by B. C. Punamia

LIST OF EXPERIMENTS:-

1. Study of Venire Theodolites
2. Angle measurement by repetition methods.
3. Angle measurement by reiteration methods.
4. Measurement of height of accessible and inaccessible point by trigonometric surveying.
5. Determination of stadia constant.
6. Distance and elevation determination by tachometric surveying.
7. Setting out of circular curve by chord and offset method.
8. Setting out of circular curve by Rankine's method.
9. Study of planimeter.
10. Study of Pantograph /Eidograph.

Under Ground Metal Mining

UNIT-I General:
Status and scope of Underground metal mining methods; various types of ore deposit; Definitions of Important terms used in underground metal mining methods. Comparison between coal mining &metal Mining

UNIT-II Development:
Mode of access; Variables affecting the choice of mode of access; Crosscuts, Levels, Raises; Their Method of drivages with the description of various unit operations; Introduction to Raise boring and Introduction to tunnel boring.

UNIT-III Stoping Methods – I:
Classification of mining methods; Factors affecting the choice of mining methods; Overhand, Underhand and Breast stoping methods; Open stoping; Vertical Crater Retreat method; Sub level stoping ;Room and Pillar method.

UNIT-IV
Stoping Methods – II:
Shrinkage stoping method; Cut and fill stoping method, Introduction to Square set stoping method, Sub Level caving, Block caving, &Top slicing method.

UNIT V Support Systems:
Pillars; Back fill, Cable bolting, Steel Rock bolts, Grouting, Shotcretingetc., code of timbering rules.

RECOMMENDED BOOKS:
1. Elements of Mining Tech. Vol II by D. J. Deshmukh
2. S M E Handbook

Blasting Engineering

UNIT I COMMERCIAL EXPLOSIVES
Type of explosives, Various Commercial Explosives and their properties, Bulk Explosive Systems, Selection of explosive. Testing, Transportation and Handling of explosives. Related regulations.

UNIT II INITIATIONSYSTEM&BLASTING ACCESSORIES
Various types of Exploder and Detonators. Detonating cord, Safety fuse, Detonating relays Non electric initiation and blasting accessories

UNIT III SURFACE BLASTDESIGN
Factors affecting blast design, Selection of various blast parameters Burden, Spacing, Stemming distance, Sub-grade drilling, Depth of hole, Bench height, Diameter of hole, Safe charge calculation, Deck Charging, Drilling patterns, Inclined hole drilling, Secondary blasting.

UNIT IV UNDERGROUND BLASTDESIGN
Various cut patterns, U/G blast design, Series & Parallel connection of detonators, Precautions during blasting,

UNIT V ROCKBREAKAGEMECHANISM
Breakage mechanism, rock fragmentation, Factors affecting rock fragmentation. Adverse effects of Blasting: Back break, over break, Fly rock, Ground Vibration and Noise, Controlled Blasting Techniques and other remedies to the blasting nuisances.

References:
1. Explosives and Blasting Technology: G. K. Pradhan
2. Surface Blast Design: C. J. Konya
3. Rock Blasting: Sushil Bhandari
4. Indian Explosive Act 1884
5. Legislation in Indian Mines –A Critical Appraisal: Rakesh and Prasad

Mine Health & Safety

UNIT I
MINE DUST
Classification, physiological effects, measurement of dust concentration, dynamics of small particles, Sampling of air borne dust, duration and interval of sampling, different method of sampling, prevention and suppression of dust, Air cleaning methods, design of enclosures for conveyor, transfer points etc.

UNIT II
MINE ILLUMINATION
Types of portable lamps, their maintenance and examination, lamp room design and Organization, Percentage and Accumulation test, light from mains, photometry and Illumination survey, standards of Illumination for underground and opencast Workings.

UNIT III
HEALTH AND MINE OCCUPATIONAL DISEASES
Health of Mine employee, first aid and ambulance, comfort condition. Various mine occupational diseases, Their causes, nature and preventive measures. Rules related with this topic.

UNIT IV
MINE ACCIDENTS
Accident and its classification, various causes of mine accidents in opencast mine and Underground mine, Preventive measure to control these accidents, relation between accident and efficiency, cost of accident: Direct and indirect cost. Various major accidents occurred in Indian coal mines.

UNIT V
ACCIDENT ENQUIRY
Notice of accident, criteria for preparation of enquiry report, preparation of accident enquiry reports.ie. Roof fall, coal dust, explosion, fire damp explosion, fire, inundation and open cast mine accidents

MINE HAZARDS

UNIT I

Mine fires and spontaneous combustion: Surface fires, its effects; causes and prevention; underground fires: Spontaneous combustion; its causes, detection and preventive measures.

UNIT II

Accidental fires causes and prevention. Physical and chemical characteristics of coal liable to spontaneous heating, Detection by practical and scientific method, preventive measures and dealing with underground fires.

UNIT III

Study of atmosphere behind sealed off area, factors of conditions for reopening: Different method of reopening, difficulties, dangers and safety measures various mean for fires fighting. Fire fighting organization.

UNIT IV

Dust in mines: Dangers, formation, prevention and suppression. Dust sampling apparatus, their construction and applications.

UNIT V

Mine Inundation: Causes and precautionary measures, bulk head doors, barriers, dams, precautions to be taken while approaching old workings, recovery of flooded mines and de watering of old workings.

Text Books:

1. Mine Env. By G.B. Mishra
2. Elements of Mining Tech. Vol.2 by D. J. Deshmukh
3. U/G Mine Env. by Mcpherson
4. Mine fires by Dr. Ramlu

List of Practical to be performed

1. Study of erection of sand bag fire stopping
2. Study of working of soda acid fire extinguishers.
3. Study of working of foam extinguishers.
4. Study of erection of German type stone dust barriers
5. Study of erection of Polish type stone dust barriers
6. Study of erection of Double brick fire stopping
7. Study of principle and working of self contained breathing apparatus Dragger 174-A
8. Study of principle and working of Aero lox Liquid oxygen apparatus.
9. Study of principle and working of self rescuers.
10. Study of various types of water dam constructed in U/G mines

SUB-SURFACE ENVIRONMENT

UNIT I

Mine Gases: Mine atmosphere its composition, Pollution of mine, air-mine gases, toxicity of gases. Origin, occurrence, physical, chemical and physiological properties of various gases and their detection. Heat and Humidity in Mines : Rock temperature geothermic gradient auto-compression, Humidity, its determination and effects. Metabolism and respiration. Climate conditions, Kata thermometer assessment of comfort conditions. Control of temperature and humidity in deep mines. Air conditioning in mines.

UNIT II

Ventilation: Necessity and standard for ventilation, Flow of air in ducts and mine roadways, resistance of airways. Law of ventilation: Chezy's and Atkinson's equation. Equivalent resistance of mines, equivalent orifice, mine characteristics.

UNIT III

Natural ventilation and its measurement, Thermodynamics of ventilation and determination of pressure volume diagram, Mine fans, principal types, their construction and working, characteristics and suitability; booster and auxiliary fans, venturi and air jets. Installation of fans, air locking arrangement, design of evasee, parallel and series operations of mines fans.

UNIT IV

Coursing, distribution and regulation of air current and splitting in underground working; Ventilation of deal ends. System of Ventilation; Forcing and exhausting, ascensional and descensional, homotropal and ntiropal ventilation.

UNIT V

Measurement of air flow and pressure ventilation survey, ventilation Calculation concerning to fans and ventilation of mines, Network problems.

RECOMMENDED BOOKS:

1. Elements of Mining Technology – Vol. II
2. Mine Ventilation – G.B.Mishra
3. U.M.S.

List of Experiments to be performed:

1. Study of gravimetric dust sampler
2. Study of thermal precipitator dust sampler
3. Study of konimeter / simslin dust sampler
4. Study of portable lamps.
5. Study of lamp room design.
6. Measurement of methane percentage
7. Study of various occupational diseases
8. Study of enquiry report related with inundation of any mine
9. Study of enquiry report related with fire damp explosion of any mine
10. Study of enquiry report related with roof fall / other accident of any mine

Mine Legislation – II

UNIT I
Principal Provisions of Mines & Minerals (Regulation & Development) Act, Coal Mines Conservation & Development Act.

UNIT II
Mineral Concession Rules, Indian Electricity Rules related to mining activity.

UNIT III
Byelaws & D.G.M.S. Circulars.

UNIT IV
Mines Rescue Rules, Mines Vocational Training Rules

UNIT V
Safety Campaign, Safety Week in Mines

RECOMMENDED BOOKS:
1. Surface Mining Technology – S.K.Das
2. Computer Graphics – K.H.Vandara
3. Auto CAD 2008 – Tymothy,Sean Sykes
4. Data Base Management System – Ravi Jasuja

MINE PLANNING

UNIT-I
Introduction: Mine planning and its components, role of planning in mining ventures; technical information for mine planning, reserve estimation

UNIT-II
Mineral inventory and ore reserves, the basis difference cutoff grade, its determination. Grade Tonnage curves and their computation

UNIT-III
Surface Mine Planning: Bench geometry and mine layouts, planning steps; determination of mine size and Taylor's mine life rule; ultimate pit configuration; mining program; haul road design

UNIT-IV
Underground Mine Planning: Mining system and sub-systems; optimal geometrical size of a mine; planning and scheduling of production. Determination of optimum Size of mine, life of mine, rate of production and mining losses, Optimization of mine design on economic considerations.

UNIT-V
Feasibility study: Its functions and preparation of feasibility report for metallic and nonmetallic minerals Details Project Repot

RECOMMENDED BOOKS:
1. An Introduction to Mineral Economics- Kaulir Kisor Chatterjee
2. Mine Economics- Arvind Kumar
3. Mineral Economics – R.K.Sinha & N.L.Sharma
4. A handbook of Surface Mine Technology- Samir Kumar Das

ENVIRONMENT MANAGEMENT IN MINE

UNIT-I

Environmental impact of Mining Projects on its various stages Waste Rock Mill tailing disposal: Characterization, Site selection, Rock and Mill Tailing disposal: Potential environment impact, Decommissioning reclamation

UNIT-II

Treatment of Acid Mine Drainage: Active and passive treatment technologies including constructed wetlands Ecological Restoration of Mining Sites: Ecological restoration, Natural restoration, Restoration planning, goal and objectives, Restoration techniques, Resilience and restoration success

UNIT-III

Post Mining Land Use: Management principles, Inventory of pre-mining land use, Post mining land uses, Selection of post mining land use

UNIT-IV

Mine Closure: Causes, mine closure objective, Planning, Closure design, Risk and Socio economic response of mine closure, Closure of mine entries

UNIT-V

Preparation of Environment management plan: Public hearing, collecting baseline data, Environment impact assessment and prediction, Environment management plan, environment monitoring and Management
Environment Protection Act 1986 and other relevant provisions for the environment applicable to mining projects

RECOMMENDED BOOKS:

1. Best Practice Environmental Management in mining
2. Environmental Management in mining areas – N.C.Saxena, Gurdeep Singh, Rekha Ghosh
3. Mine Closure – N.C.Saxena
4. Introduction to Environmental Impact Assessment – John Glasson, Riki Therivel & Andrew Chadwi

Rock Mechanics

UNIT-I
INTRODUCTION
Application of rock mechanics in mining, Definition of important terms used in Rock mechanics, Classification of rock mass, Parameters of rock mass classification, Importance of rock mass classification, RQD, Q –system and Bieniskiwi's Geomechanics, classification of rock mass.

UNIT-II
Rock properties, Physico-mechanical properties of rock, Preparation and testing of specimen in the laboratory, ISRM standards, Determination of Physico-mechanical properties of rock as per ISRM standard testing procedures, Strength indices and their importance. Point load, Protodyaknov, Impact and Cone Indenter strength Index

UNIT-III
Rock as an elastic medium, Principle of elastic analysis, Rheological properties of rock, Importance of rheological models, Different types of rheological models, Dynamic properties of rocks, Anisotropy and Creep

UNIT-IV
Principal stress and Principal plane, Analytical method of determining the magnitudes and directions of normal and shear stress on failure plane, Mohr's circle, Theories of failure of rock, Coulomb-Navier theory, Mohr's theory, Griffith's theory, Empirical theories of failure of rock, Different modes of failure of rock

UNIT-V
Earth stresses, Importance of measurements of in situ stress, measurements of in situ stress by Flat jack, Over coring and Hydraulic fracturing technique. Design of circular and elliptical openings. Determination of safe span of roof.

RECOMMENDED BOOKS:
1. Rock Mechanics By Obert abd Duvall
2. Rock Mechanics By Goodman
3. Rock Mechanics By Jager & Cook
4. Rock Mechanics by B.S. Verma

List of Practical to be performed

1. Determination of moisture content of rock sample by ISRM standard method
2. Determination of porosity of rock sample by ISRM standard method
3. Determination of Density of rock sample by ISRM standard method
4. Determination of slake durability strength index of rock sample by ISRM standard method
5. Determination of point load strength index of rock sample
6. Determination of Proto-dyakonov strength index of rock sample
7. Determination of Uni-axial Compressive strength of rock sample by ISRM standard method
8. Determination of Tensile strength of rock sample by Brazilian method
9. Determination of Single Shear and Double Shear strength of rock sample
10. Determination of Tri-axial Compressive strength of rock sample by ISRM standard method
11. Determination of Young' Modulus of rock sample by ISRM standard method

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Advanced Mine Surveying

UNIT I

Correlation: Methods of correlation of surface and underground surveys through inclines, One or two vertical shafts, steeply inclined shafts, Correlation by magnetic needle, Precautions and accuracy, Use of Gyroscope.

UNIT II

Stope and Face Surveying: Use of Miner's dial, Hanging compass with clinometers and theodolite in stop surveying, Tape triangulation, Traversing, Radiation and other methods, Plan meter and its use, Mine Plans and Sections: Legal requirements as to mine plans in India, preparation and preservation of plans and section, Representation of geological and other features in mine plans and sections, Tridimensional drawing, Enlargement of plans, Use of ideograph and pantograph preparation of mine modes.

UNIT III

Photogrammetry: Introduction to Photogrammetry, Scale of a vertical photograph, Photograph versus maps, Application of Photogrammetry in mining, Dip & Fault problems, Application of GIS, GPS and other information Technology tools in surveying and computations.

UNIT IV

Astronomical Survey Definitions of important terms, spherical trigonometry, various coordinate systems in field astronomy, Determination of azimuth by astronomical observations, Calculation related with field astronomy.

UNIT V

Modern Surveying Techniques Principle of EDM, Electronic distance measuring equipment; Merits and demerits of EDM, Geodimeter, Tellurometer, Distomat, Total Station, Introductory knowledge of Remote Sensing and Global Positioning System .Surveying software

RECOMMENDED BOOKS:

1. Elements of Mining Tech. (Vol- I), D. J. Deshmukh.
2. Surface Mining Technology, Samir Kumar Das.
3. Elements of Mining Tech. (Vol- I), D. J. Deshmukh.
4. Surface Mining Technology, Samir Kumar Das.
5. Heavy Earth Moving Machines, Amitosh de. U M S

LIST OF EXPERIMENTS:

a. Setting out of S-curves
b. Setting out a circular curve
c. Theodolite surveying
d. Application of GIS, GPS

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.

Rock Stability Engineering

UNIT-I

Design and Stability of Structures in Rock:

Initial rock pressure due to narrow and wide excavations. Theories of ground movement, criteria for design and support of underground excavations; design of single and multiple openings in massive, stratified and jointed rock mass; mine pillars and their classification, pillar stresses, pillar design, stability analysis of pillars.

UNIT-II

Subsidence:

Causes and impacts of subsidence; mechanics of surface subsidence, Vertical and lateral movements and their estimation; angle of fracture, angle of draw; factors affecting subsidence, discontinuous and continuous subsidence; monitoring, prediction.

UNIT-III

Caving of Rock mass:

Caving characteristics of rocks; capability index, subsidence control protection of surface structures, design of protection pillars including shafts pillars.

UNIT-IV

Rock burst: Phenomenology of rock bursts; prediction and control of rockroses; bumps and gas outbursts,

Introduction to Methods of Stress Analysis: Predictive methods for mine design; principles of classical stress analysis closed form solutions for simple excavation shapes; introduction to computational methods of stress analysis finite element, boundary element, distinct element methods and hybrid computational schemes.

UNIT-V

Monitoring Rock mass Performance: Purpose and nature, monitoring systems including seismic and micro-seismic methods. Mechanics of Fragmentation: Mechanism of rock cutting by picks, disc and roller-cutters; water-jet cutting; mechanics of blasting; methods of assessing cut-ability.

RECOMMENDED BOOKS:

1. A handbook of Surface Mine Technology- Samir Kumar
2. Rock Engineering- John A Franklin & Maurice B. Dusseault
3. Rock Engineering- Evert Hoek

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.

Metalliferous Mining

UNIT-I

Present status of drilling and blasting practices in India and abroad: Methods of drilling for production of minerals from surface and underground mines, rotary, percussive and rotary –percussive drilling, different types of bits, bit wear, different types of machines, hydraulic drills, long hole drilling.

UNIT-II

Variables in drilling, optimization of drilling parameters, mechanics of drilling, drill-ability of rock, boring in rocks.

UNIT-III

Recent developments in explosives and blasting techniques. Explosives and Blasting Systems, Monitoring Blasting Results: Borehole pressure, transducer, V.O.D. Probe, vibration monitor, high speed video camera, blast design, mechanics of blasting. Computational models of blasting. Influence techniques, Overcastting with explosives. Nuclear blasting, Safety.

UNIT-IV

Explosives:

Classification and comparative properties of explosives, blasting devices, general application and uses; safety considerations. Blasting damages, ground vibrations and air blast. Impact of ground vibration and air blast on the neighboring structures and communities and mitigate measures, reinforcement and design alternatives.

UNIT-V

Blasting Systems:

Electric and non-electric methods, delay blasting techniques, priming, charge distribution, Mechanism of rock blasting. Alternative methods of rock fragmentation. Novel methods of drilling, choice of drills.

RECOMMENDED BOOKS:

1. A Study of Metalliferous Mining – Y.P.Chacharkar
2. Rock Fragmentation – B.Mohanty
3. Rock Fragmentation – Wayne S. Brown

Mine Economics

UNIT I
Sampling- Methods of sampling, errors in sampling, analysis of samples, estimation grade and reserves, salting and precautions against salting. Different types of reserves

UNIT II
Mine Valuation - Different methods, depreciation, amortization and redemption of capital, Life of a mine and present value of a mine.

UNIT III
Financial Management - Methods of framing and financing industrial enterprises, memorandum and articles of association, shares, debentures, dividends and interest. Break even chart and inventory control.

UNIT IV
Investment Decisions - discounted cash flow methods, non-discounted cash flow methods, advantages and disadvantages of them, internal rate of return, Net Present Value.

UNIT V
Book Keeping, Preparation of Balance sheet, Profit and Loss Account.

Reference Books:-

1. Mineral Economics by R.T. Deshmukh
2. SME Handbook Vol. I
3. Mineral Economics by Sinha and Sharma

RECOMMENDED BOOKS:

1. Engineering Geology by S.k. Garg
2. Economic Geology by P.K. Mukharjee
3. Economic Geology – Sen & Ghua
4. Indian Mineral Resources – D.K.Banerjee
5. Textbook of Geology – G.B.Mahapatra
6. General & Engg. Geology- Prabin Singh

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Pollution Control in Mining

UNIT I
ENVIRONMENTAL POLLUTION
Introduction and classification of environmental pollution, ecological conservation. Salient features of the environmental laws in India, Occupational disease

UNIT II
AIR POLLUTION
Air pollution due to various gases and suspended particulate materials, causes, consequences, Green House effect, Ozone Depletion, Acid Rain, Preventive Measures against air pollution, dust sampling equipment.

UNIT III
WATER POLLUTION
Water pollution, its causes and preventive measures, acid-mine drainage, water pollution in mines and mineral beneficiation plants, water treatment & purification schemes in brief.

UNIT IV
LAND POLLUTION
Land pollution: its causes and preventive measures, Land scape pollution and land reclamation, methods of land Reclamation, Mine closure plan.

UNIT V
NOISE POLLUTION
Pollution due to noise and its consequences, Sources of noise, permitted level of noise, noise produced by different machinery, control and safety measures, measurement of noise level.

RECOMMENDED BOOKS:
1. Air & Water Acts
2. Forest Conservation acts
3. Legislation in Indian Mines – A Critical appraisal by Rakesh and Prasad
4. Env. Impact of Mining By Down and Stokes

List of Practical to be performed:

1. Study of Konimeter
2. Study of Dust precipitator
3. Study of gas chromatograph
4. Study of noise measuring instruments
5. Measurement of noise
6. Study of noise controlling techniques
7. Study of vibration measuring instruments
8. Measurement of vibration
9. Study of land reclamation methods
10. Preparation of EIA and EMP for a mining project

Mining Machinery - III

UNIT I FACE MACHINERY
Drills for coal and stone: their constructional details, Drill jumbos: their applications, operation and maintenance, Introduction to coal cutting machine.

UNIT II LOADER AND TRANSPORTING MACHINE
Rocker shovel, gathering arms loaders, LHD and SDL machines: their construction, operation and maintenance, Cavo loader, shuttle car and underground trucks: their construction, operation and application.

UNIT III
CUTTER LOADERS
Different types of cutter loaders suitable for long wall and short wall faces: their constructions, operation and maintenance, different types of road headers: their construction, operation and conditions of applicability, mechanics of rock cutting, rock cutting tools and their performance.

UNIT IV
COMPRESSED AIR
Basic concept, compression process, working and constructional features of single stage and multistage compressor, unloading arrangement of compressor, layout of pipelines, Transmission of compressed air, testing of Compressor, In bye compressors.

UNIT V
USE OF ELECTRICITY IN MINES
Flame proof apparatus, intrinsically safe circuits, underground cables, drill panel, gate end box, circuit breakers, remote control (pilot circuit), underground substation, earth leakage protection, cable joining, Electrical signaling

Reference books:
1. Elements of Mining Vol. III by D. J. Deshmukh
2. UMS Booklet
3. Winning and Working of Coal : R. T. Deshmukh & D. J. Deshmukh
4. Modern Coal Mining Practices : R. D. Singh
5. Longwall Mining : Syd. S. Chaing & Peng

ECOMMENDED BOOKS:

1. Engineering Geology by S.k. Garg
2. Economic Geology by P.K. Mukharjee
3. Economic Geology – Sen & Ghua
4. Indian Mineral Resources – D.K.Banerjee
5. Textbook of Geology – G.B.Mahapatra

General & Engg. Geology- Prabin Singh

List of Practical to be performed:

1. Study of working and construction of Rotary Coal Drill Machine used in U/G Coal Mine.
2. Study of working and construction of Jack hammers drill used in Metal Mine.
3. Study of working and construction of Long Wall Coal Cutting Machine
4. Study of working and construction of Side dump loader.
5. Study of working and construction of a LHD
6. Study of Double ended ranging drum shearer.
7. Study of drill panel and gate end box.
8. Study of working and construction of Gathering Arm Loader.
9. Study of working and construction of Coal Plough.
10. Study of working and construction of Torque Convertor.
11. Study of working and construction of Reciprocating Compressors.

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Surface Mining

UNIT I
Layouts of open pit mines, Methods of side casting, Side casting by Stripping Shovel and Dragline, Range Diagram, calculation of operating radius. Explosive casting, Layouts of waste dumps. Design of Haul roads.

UNIT II
Introduction to continuous surface mining equipment, Bucket wheel excavators: construction, basic operation and productivity calculation, Continuous surface miner: construction, basic operation and productivity calculation. Face Layouts.

UNIT III
Ultimate pit design, Factors affecting ultimate pit limits; Significance of ultimate pit limits; Manual methods of developing ultimate pit limits. Floating cone technique, Production planning, Basics of mine life and plant size concepts, Mine and Mill plant sizing,

UNIT IV
Introduction to rock slope engineering, Slopes in surface mines and their formation, Pit slopes and their influence on mine economics, Slope stability, Factors influencing slope stability, Various types of slope failure and their conditions.

UNIT V
Determination of factor of safety of a slope under plane and circular failure, Planning of slope stability investigations, Stabilization and protection methods for stability of slopes.

RECOMMENDED BOOKS:

1. Surface Mining : G.B. Misra
2. Surface mining equipment : Martin
3. Surface Mining : Pfleider
4. Rock slope engg. : Hoek & Bray
5. SME handbook : Hartman
6. Surface Mine Planning & Design : Hustralid & Kuchha

Strata Control

UNIT I
SUPPORTS
Timber & steel supports, Examination of roof, Roof bolting, roof stitching, method of supporting roadways. Supporting under different conditions viz. Pit bottom, crossing, junctions, faulted area, longwall faces, depillaring areas and stoping areas, support loads .SSR, CTR, Support plan, Support withdrawal.

UNIT II
POWERED SUPPORTS
Powered supports: their principles of operation, Frame support, Chock support, shield support & chock shield support: Classification, designation, constructional features, merits demerits and applications, Hydraulic fluids, power pack.

UNIT III
STOWING
Principal methods of stowing, their relative merits, demerits and applicability, Hydraulic stowing, Pneumatic stowing, Mechanical stowing, Hand packing, face arrangements, pipe wear, pipe jams. Hydraulic gradient.

UNIT IV
STRATA CONTROL
Theories of ground movement, Rock pressure due to Narrow and Wide excavation, Front abutment and back abutment, Failure of roof and floor, measurement of strata movement, Causes and preventive measures against Rock burst, Bumps& Gas outbursts.

UNIT V
SUBSIDENCE
Theories of subsidence, Types of subsidence, damage and loss due to subsidence, vertical and lateral movements and their estimation, angle of fracture and angle of draw, factors affecting subsidence, subsidence control, protection of surface structures, design of protective pillars including shaft pillars. Pot holes.

RECOMMENDED BOOKS:

1. Strata control in mines : Chaing & Peng
2. Winning and Working of Coal : R. T. Deshmukh & D. J.Deshmukh
3. Modern Coal Mining Practices : R. D. Singh
4. D.G.M.S. Circulars (Tech.) 1995 onwards
5. Longwall Mining : Syd. S. Chaing & Peng

List of Practical to be performed:

1. Study of Conventional support systems.
2. Study of constructional features and working of Friction props
3. Study of constructional features and working of Hydraulic props
4. Study of methods to support roof by roof bolts, roof stitching and cable bolts
5. Study of withdrawal of supports by Sylvester prop withdrawer
6. Study of methods to support junctions and faulted area
7. Study of constructional features and working of Powered Supports
8. Study of Hydraulic stowing System and the arrangement required for it
9. Study of pneumatic stowing System and the arrangement required for it
10. Study of Subsidence measurement techniques.

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Major Project

The student should prepare a working system or some design or understanding of a complex system that he has selected from the previous semesters using system analysis tools and submit the same in the form of a write-up i.e. detail project report. The student should maintain proper documentation of different stages of project such as need analysis, market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan wherever applicable. Each student is required to prepare a project report based on the above points and present the same at the final examination with a demonstration of the working system.