TS ECET-2019

SYLLABUS FOR MINING ENGINEERING

MATHEMATICS (50 Marks)

Unit-I: Matrices
Matrices: Definition of Matrix, Types of matrices-Algebra of matrices-Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Properties-Laplace's expansion-singular and non singular matrices - Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Crammer's rule, Matrix inversion method,-Gauss-Jordan method.
Partial Fractions: Resolving a given rational function into partial fractions.
Logarithms: Definition of logarithm and its properties, meaning of 'e' exponential function and logarithmic function.

Unit–II: Trigonometry
Properties of Trigonometric functions– Ratios of Compound angles, multiple angles, submultiple angles – Transformations of Products into sum or difference and vice versa- Simple trigonometric equations–Properties of triangles–Inverse Trigonometric functions, Hyperbolic functions.
Complex Numbers: Properties of Modulus, amplitude and conjugate of complex numbers, arithmetic operations on complex numbers-Modulus-Amplitude form (Polar form) - Euler form (exponential form)-Properties.

Unit–III: Analytical Geometry
Straight Lines–different forms of Straight Lines, distance of a point from a line, acute angle between two lines, intersection of two non-parallel lines and distance between two parallel lines. Circles-Equation of circle given center and radius, given ends of diameter-General equation-finding center and radius, center and a point on the circumference, 3 non-collinear points, center and tangent, equitation of tangent and normal at a point on the circle.

Unit–IV: Differentiation and its Applications
Functions and limits – Standard limits – Differentiation from the First Principles – Differentiation of sum, product, quotient of functions, function of function, trigonometric, inverse trigonometric, exponential, logarithmic, Hyperbolic functions, implicit, explicit and parametric functions–Derivative of a function with respect to another function-Second order derivatives – Geometrical applications of the derivative(angle between curves, tangent and normal)–Increasing and decreasing functions–Maxima and Minima(single variable functions) using second order derivative only - Partial Differentiation–Partial derivatives up to second order–Euler's theorem.

Unit–V: Integration and its Applications
Indefinite Integral – Standard forms – Integration by decomposition of the integrand, integration of trigonometric, algebraic, exponential, logarithmic and Hyperbolic functions– Integration by substitution –Integration of reducible and irreducible quadratic factors – Integration by parts– Definite Integrals and properties, Definite Integral as the limit of a sum –

Application of Integration to find areas under plane curves and volumes of Solids of revolution–
Mean and RMS value, Trapezoidal rule and Simpson's 1/3 Rule for approximation integrals.

Unit–VI: Differential Equations

Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solution of differential equation of the type first order, first degree, variable-separable, homogeneous equations, exact, linear differential equation of the form $dy/dx+Py=Q$, Bernoulli's equation, nth order linear differential equation with constant coefficients both homogeneous and nonhomogeneous and finding the Particular Integrals for the functions e^{ax}, x^m, $\sin ax$, $\cos ax$ or a polynomial of m-th degree(m=1,2).

Unit–VII: Laplace Transforms

Laplace Transforms (LT) of elementary functions-Linearity property, first shifting property, change of scale property multiplication and division by t-LT of derivatives and integrals, Unit step function, LT of unit step function, second shifting property, evaluation of improper integrals, Inverse Laplace transform(ILT)-shifting theorem, change of scale property, multiplication and division by p, ILT by using partial fractions and convolution theorem. Applications of LT to solve ordinary differential equations to solve ordinary differential equations up to second order only.

Unit–VIII: Fourier Series

Define Fourier series, Euler's formulae over the interval $(C, C+2\pi)$ for determining the Fourier coefficients. Fourier series of simple functions in $(0, 2\pi)$ and $(-\pi, \pi)$.Fourier series for even and odd functions in the interval $(-\pi, \pi)$.

PHYSICS (25Marks)

Unit-I: Units and dimensions:

Physical quantity-fundamental and derived physical quantities-units-fundamental and derived units-SI units-multiples and sub-multiples in SI units-advantages of SI units-dimensions and dimensional formulae-dimensionless quantities- applications and limitations of dimensional analysis-problems.

Unit-II: Elements of vectors:

Scalar and vector quantities-examples-types of vectors-addition and subtraction of vectors-triangle law-parallelogram law-polygon law-resolution of a vector-unit vectors(i,j,k)-dot product and cross product of two vectors- characteristics of dot and cross products-examples- problems.

Unit-III: Kinematics and Friction

Equations of motion-acceleration due to gravity-equations of motion under gravity- projectile motion-examples-horizontal and oblique projections-expressions for maximum height, time of ascent, time of flight, horizontal range, problems. Friction- causes and types of friction-normal reaction-laws of friction-coefficients of friction-angle of friction-methods of reducing friction-advantages and disadvantages of friction-motion of a body over a rough horizontal surface–problems.

Unit-IV: Work, Power and Energy
Work, power and energy-definitions and units-potential and kinetic energies-examples and expressions-work-energy theorem – law of conservation of energy-problems.

Unit-V: Simple harmonic motion and Sound
Definition-conditions of SHM - examples of SHM - expressions for displacement, velocity, acceleration, time period, frequency and phase of SHM-time period of a simple pendulum-seconds pendulum-problems. Sound-musical sound and noise-noise pollution-Effects and methods of control of Noise Pollution-Beats and echo's-problems-Doppler effect– Explanation, and Applications --Reverberation-Sabine's formula-characteristics of a good building-problems.

Unit-VI: Heat and Thermodynamics
Expansion of gases-Boyle's law-Absolute scale of temperature-Charles laws-Ideal gas equation-Universal gas constant and its value-SI Units-problems-- isothermal process-adiabatic process-first law of thermodynamics - two specific heats of a gas-relation between C_p and C_v-problems-second law of thermodynamics.

Unit-VII: Modern physics
Photo electric effect–explanation and its laws-applications of photo electric effect (photocell)-Einstein's photoelectric equation–critical angle and total internal reflection– optical fibers - principle, working, types and applications-concept of super conductivity – and applications.

CHEMISTRY (25 Marks)

Unit I: Fundamentals of Chemistry:
Atomic structure: Introduction-Fundamental particles – Bohr's theory – Quantum numbers – Aufbau's principle – Hund's rule – Pauli's exclusion principle- Electronic configurations of elements up to atomic number 30, shapes of **s**, **p**, **d** orbital's.
Chemical Bonding: Introduction – types of chemical bonds – Ionic bond taking example of NaCl and MgO –characteristics of ionic compounds and covalent bond taking example H_2, O_2, N_2, HCl, characteristics of covalent compounds-Coordinate covalent bond.
Oxidation-Reductions: concepts of Oxidation-Reduction, Oxidation number and its calculations, differences between oxidation number and Valency.

Unit-II: Solutions:
Introduction classification of solutions, solute, solvent, concentration, mole concept–Molarity – Normality, equivalent weight using acids, bases and salts, numerical problems on Molarity and Normality**.**

Unit-III: Acids and Bases:

Introduction – theories of acids and bases – Arrhenius, Bronsted – Lowry theory – Lewis acid base theory – Ionic product of water - pH and related numerical problems – buffers solutions – Applications.

Unit – IV: Principles of Metallurgy:
Characteristics of metals and distinction between metals and non-metals. Definitions of metallurgy, ore, gangue, flux, slag–concentration of ore-hand picking, levigation, froth floatation – extraction of crude metal – roasting calcination, smelting – alloys – composition and uses of brass, German silver and nichrome.

Unit-V: Electrochemistry:
Conductors, insulators, electrolytes - Arrhenius theory of electrolytic dissociation – electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electro chemical series –emf and numerical problems on emf of a cell.

Unit –VI: Corrosion:
Introduction – factors influencing corrosion - electrochemical theory of corrosion-composition cell, stress cell and concentration cells - rusting of iron and its mechanism – prevention of corrosion by (a) coating methods, (b) cathodic protection (sacrificial and impressive voltage methods).

Unit-VII: Water Technology:
Introduction – soft and hard water – causes of hardness – types of hardness –disadvantages of hard water – degree of hardness, units and Numerical problems– softening methods – permutit process – ion exchange process – qualities of drinking water – municipal treatment of water for drinking purpose - Osmosis and reverse Osmosis, advantages of reverse Osmosis.

Unit-VIII: Polymers:
Introduction – polymerization – types of polymerization – addition, condensation polymerization with examples – plastics – types of plastics – advantages of plastics over traditional   materials – Disadvantages of using plastics, thermo plastics and thermo setting plastics– differences between thermo plastics and thermo stetting plastics- preparation and uses of the following plastics: 1. Polythene, 2. PVC,   3. Teflon,   4. Polystyrene,   5.Urea formaldehyde – Rubber – natural rubber – processing from latex –Vulcanization – Elastomers – Butyle rubber Buna-s, Neoprene rubber and their uses.

Unit-IX: Fuels:
Definition and classification of fuels based on physical state and occurrence – characteristics of good fuel - composition and uses of gaseous fuels. (a) Water gas, (b) producer gas, (c) natural gas, (d) coal gas, (e) bio gas, (f) acetylene.

Unit-X: Environmental Chemistry:
Introduction – environment – understand the terms lithosphere, hydrosphere, atmosphere bio sphere, biotic component, energy component pollutant, receptor, sink, particulate, DO, BOD, Threshold limit value, COD - Air pollution - causes-Effects- Forest resources, uses and over exploitation, deforestation   acid rain, green house effect –ozone depletion – control of Air pollution – Water pollution – causes – effects – control measures. Renewable and Non Renewable energy sources – concept of ecosystem – producers, consumers and decomposers – Biodiversity, threats to Biodiversity.

MINING ENGINEERING (100 Marks)

UNIT I:
ELEMENTS OF MINING:
Definitions of Terms, Mineral based industries, Mining operations, modes of entry, shaft, incline, adit-applicable conditions, Mining Methods used in coal and Non coal mining, Classification of the mineral deposits based on various factors, classification of coal seams based on various factors. Classification of methods of working-U/G Coal, OCM & Metal Mining, Bore(Drill) holes uses, classification and various tools used in boring(Drilling), feed mechanism, core recovery, deviation of boreholes. Explosives- Characteristics, classification, composition, properties, different explosives used in U/G, OCM, Metal and coal mines, selection of explosives and initiation of explosives, Detonators- types, Blasting practice in Mines- terms, tools, sequence of shot firing, drill patterns types, misfires, blown out shots, sockets, treatment of misfires dangers associated with underground blasting, precautions to be taken before and after blasting, simple problems on powder factor yield/kg of explosives-drill bits-drill – Water conditioning – fuse – electric blasting. Mine Gases- types, physical and chemical properties, physiological effects and occurrence, flame safety lamp-purpose, principle constructional details of bottom, top feed types- method of heat transfer, accumulation and percentage test, different detectors .Shaft sinking methods – sinking through normal strata, Special methods of shaft sinking pilling, drop shaft method, widening and deepening– modern trends, cementation, freezing method. Temporary, permanent lining of shafts. Support- Necessity, classifications, materials used for supports, classification of supporting system application of various types of supports in coal by metal mining, size-shape of supports, Principle of roof bolting, stitching, merits and demerits of bolting, rigid - yielding props-construction details, Friction-Hydraulic supports-method of setting-load yield characteristics -fore poling, safari supports, junction supports, clearance of heavy roof fall, systematic supporting rules – withdrawal of support problems on load bearing capacity of friction props-factor safety roof bolts.

UNIT II:
MINING GEOLOGY:
Definition of the term Geology, scope, uses of geology in Mining field, Branches of geology, Age of the earth, origin of the earth-Nebular hypothesis of Kant and Laplace, Physical Geology, internal structure of earth, weathering, erosion, denudation, Attrition, Abrasion, Earthquakes, its propagation, intensity, causes and effects of earthquakes. Volcanoes and its classification, Mineralogy-Physical characteristics of minerals, important mineral families, industrial uses of important minerals; Occurrence and distribution in A.P and India. Petrology- Classification of Rocks and its characteristics, structures and textures. Structural Geology, folds ,faults, joints, unconformities. Geological time scale, major stratigraphical divisions of India, Physio-graphic divisions of India, Economic Geology-Terms, processes of mineralization and important economic minerals formed by these processes. Geological prospecting- objectives, guidelines for location of mineral deposits in fields, methods of prospecting. GIS and Remote sensing concepts. Coal Geology-Periods of coal formation, stages of coal formation, origin of coal seams, drift and insitu theories, structural features of coal seams, distribution of coal seam in India, and Telangana state.

Petroleum Geology-Origin, migrations, and accumulations ,distribution of oil fields in world and India

UNIT III:
METHODS OF WORKINGCOAL:

Methods of working Bord and pillar- applicability –merits – demerits – different terms – stages of development and deplillaring – panel system –types –applicability- factors influencing this size of panel – general considerations- number of opening of panel-merits, demerits – factors governing the selection of the development method -opening of districts, different methods of development systems, along dip along strike, cross cuts, steeply dipping seems loading machines and continuous miners, blasting of solids, different conveyers ,coal cutting machines LHD,SDL depillaring, terms – classification-planning preparation arrangements – sequence of operations – pillar extraction under week roof mechanized method of pillar extractions by LHD ,SDL – conveyor systems – size ,shape of pillar, ribs – local fall –main fall-air blast, dangers precautions- stowing- methods conditions for adoption of stowing-H/L ratio ,preparatory arrangements for stowing-stowing panel-danger and precautions while working below goafed areas- contiguous seams extractions precautions against fire during and after depillaring Long wall mining- drivage of road ways by drill blast by manual loading, by gathering arm loader, by road header, dint header, continuous miner, Long wall advancing- applicability, merits, demerits, limitations comparison between long wall retreating and advancing, machinery employed-continuous mining method – factors governing length of long wall face, layout conventional long wall face ,advancing with caving and stowing – layouts of mechanized long wall face advancing with caving and stowing comparison with bord and pillar- production calculation –long wall retreating method – applicability –layout of mechanized /conventional long wall with caving and stowing, layout of long wall face with shearer – methods of sumping –method of push- salvaging-productions calculations. Blasting gallery method- applicability, merits, demerits, limitations. –drilling –blasting pattern – loading operations – supporting –spacers-precautionary measures at goaf edge line development of BG panel- mechanized layout of BG panel-production calculations thin seem mining –applicable condition of plough – method of working uni - directional – bi-directional method, over passing ,types of coal ploughs, cutting operations plough-Thick seam mining by slicing –difficulties-methods-applicability inclined slicing, horizontal slicing, with caving and stowing- blasting gallery, sublevel caving with mechanized long wall -horizon mining. Merits- demerits applicability, limitations-Hydraulic mining-applicability-merits and demerits-Hydraulic breaking of coal-transport-layout of Hydraulic mining in moderately thick and steep seems – Gasification of coal applicability – merits –demerits – principle of Gasification-opening of coal seems with gasification, linkages bore holes in gasification of coal, Stowing practice in mines, subsidence-subsidence survey, its effects and remedial measures- Surface mining-definitions- different forms-geo mining situations, major coal and metal Opencast-limitations-merits and demerits- different terminology with sketches-stages of surface mining –Equipment-machinery for preparing ground, dozed scraper, ripper, road grader, road rollers-classifications of dozer, components- functions, operations-classification of rippers-road grader main components functions and operations classification of road roller, components functions and operations-Drilling and OC mines –classification of drill host – vertical and inclined drilling – merits-demerits various parameters-drill parameters-

application- estimation of charges for blasting round of holes, blasting tools-shot firing procedure-patterns-blasting techniques –transportation-storage –charging of bulk explosives-use of NONELS-electronic detonators, boosters firing procedure –use of bulk explosives.

–control blasting techniques –applicability-conditions for adopting sleeping hole –secondary blasting techniques – danger due blasting in OC mines preventive measures-OC machinery – selection-classification of HEMM - application –Excavators used in open cast mines –all types of excavators-shovel-dragline – BWE-surface miner applicability's merits-demerits etc.-All types of transport system in opencast mines-dumpers, belt conveyors – rail-pipeline-high angle conveyor – types -merits-demerits-applicable condition of inpit crusher technology spreaders-working –slope stability in OC benches – factors-terms – simple problems – slope failures – types – preventive measures of slope failure-problems on factor of safety of bench slope-various layout of opencast mines -design factors of layout- different combinations layout – shovel dumper, drag line, surface miner, bucket wheel excavator - impact on environmental and ecology in OC mines – terms- various pollutions –causes-preventive measures-relationship between ecology and environment - BOD methods-calculations of BOD –EIA, EMP, land reclamation

UNIT IV:
METHODS OF WORKING METAL:
Definitions-calcification of mineral deposits- comparison between coal and non coal-Development of mineral deposits, levels, sublevels, Winzes and Raises etc., Handling waste rock and mineral, Drilling and blasting, arrangement for loading, conventional and mechanized methods of raising, -merits-demerits method of raising of all raising methods TBM, drivage in metal mines –winzes –raises merits-demerits - various stopping methods, classification selection of stopping methods, breast, under hand, overhand, open strokes , filled, shrinkage cut and fill, sublevel, Block caving, top slicing, VCR, Ring hole drill, square set, stopping methods-merits – demerits-limitations Sampling-Classification of sampling methods, reduction of xsamples, salting preventive measures, Assaying, Assaying plans, valuation of mines, problems associated with deep mining. Rock mechanics- concepts ground forces, stress distribution in underground properties of rocks, rock indices, failure of rocks theories of rock movements and strata control and ground subsidence, ore dressing, necessity, processing, advantages coal cleaning and mineral processing, comminution, objectives classification of process law of comminution, principles of crushing, classification of crushing operation, types of crushes, grinding mills etc. ,industrial sizing methods definitions etc, concentration techniques etc, clean coal technology.

UNIT V:
MINE ENVIRONMENTAL ENGINEERING - 1:
Ventilation - purpose types – systems of ventilation – down cast –up cast shaft - natural ventilation-factors influence NV definition of NVP –motive column –derivation applications – calculation of NVP and mechanical ventilation, classification of Centrifugal, axial flow fans principle and construction details Distribution of mine air, ventilation devices, construction location and application. Auxiliary ventilation, Booster ventilation, Homotropal, anti-tropal systems. Laws of mine air friction, Equivalent orifice of a mine, numerical problems, laws relative to passage of mine air, Atkinson's and modified Atkinsons equations ,relation between pressure resistance –Formulas- splitting of air current, laws of

mechanical ventilations, Determination of Fan efficiency Ventilation survey –Quality-Quantity-Pressure surveys-cooling power mine-kata factor –kata thermometer. Gas detectors-types, uses, application, principles, determination percentage of gases using conventional methods and using latest detectors.

UNIT VI:
MINE ENVIRONMENTAL ENGINEERING - 2:

Mine fires, classification, causes preventive measures spontaneous heating of coal, different methods of dealing with fires, Collection of air samples and interpretation of Mine air samples, Ventilation survey, types, instruments, Mine Explosions – Types, Fire damp explosions- causes and preventive measures, Coal dust explosions, causes and preventive measures, treating coal dust, dust barriers, water barriers, methane drainage Mine inundation dangers –precautions in water logged areas burn side safety boring operates, Inundation in mines, its causes, precautions, design of dams. Gas detectors user's principles –remote sensing devices –continues recorders – monitors warm blooded birds. Continuous monitoring Mine lighting, monitoring a velocity, quantity ,Tele- monitoring ,merits-demerits, purpose, lighting – method and standers of lighting Places to be illuminated in open cast and under ground mines and solve numerical problems on illumination . Miners diseases, causes and preventive measures, symptoms, treatment of jaundice, ankylostomiasis – nystagemus, pneumoconiosis, asbestosis, silicosis, sidirosis, manganese poisoning-lead poisoning, chromium poisoning, radio active minerals , pollution and control methods-rescue and recovery operations –definitions-rescue apparatus –photo mark IV ,principle, functions, tests, care and maintenance smoke helmet –purpose, construction details – gas mask – purpose, construction details, functions, self rescues purpose –functions, construction details – rescue station – organization – water rescue and recovery.

UNIT VII
MINE SURVEYING:

Definitions, Principles, classifications, Measurement of distances, Various instruments used in Surveying, chain survey, Fundamentals of compass survey, limitation of various surveying methods, various methods of leveling, types of levels, instruments, adjustments, computations, curvature, refraction, reciprocal leveling-merits- applicability-problems-permissible error, contouring and subsidence-purpose-purpose of HFL-contouring methods-interpolation theodolite- terminology-fundamental lines- types, adjustments-measuring of angels, traversing and computations , permissible error-distribution calculation of latitude and departure-problems- rectangle coordinators calculations of areas Bowditch rules, setting out curves, types, definition - classification –method of setting-curves – simple problems, correlation survey - purpose, methods – simple problems, tachometric survey-principles-systems- methods problems, Dip, Strike, Fault problems and, Electronic survey instruments –history, basics, principles-EDM instruments-gyro meter –applicability uses construction details ,Remote sensing –history, definitions, EMR, sensors, data transmissions storage, application and mining global positioning system and GIS, fundamentals, GPS observations', data processing, error correction, planning, Maps, total station, use ,setting up –observations measuring and distances and angles –establishing TBM station elevation –remote elevation, auto CAD.

UNIT VIII:
MINING MACHINERY – 1:
Wire ropes- usage, chemical composition, tests of wires, classification, applicability of different wire ropes, causes of deterioration and precautions, selection parameters- numerical problems on size-weight and strength, capping, recapping methods and rope splicing, description Transportation in mines - classification different types of rope haulages, their applicability, merits and demerits limitations. Safety devices in different rope haulages, laying and maintenance of track-details of mine car, factors of section of rope haulage computation of problems for HP, rope size, breaking strength, tub capacity, number of tubs, conveyors –classification different types of conveyors, construction safety devices merits- demerits limitations, solves numerical problems on size, output motor HP, Locomotive haulages- types, applicability's, merits-demerits, classify aerial rope ways, applications ,simple problems, pumps –terms ,classification types of pumps, fittings, merits-demerits, limitations ,selection-problem on head, quantity HP, frictional losses   their applicability in mines, construction details merits, demerits and limitations.

UNIT IX:
MINING MACHINERY – 2:
Coal face machinery, different Drills, Power loaders, Long wall face machinery-AFC , lump breakers, stage loaders, power pack, SERDS, DERDS, safety devices, power support, , Flame proof apparatus and Intrinsically safe apparatus- field of applications, features, remote control principle, Signaling methods used in mines, telephones, winding -purpose, equipment, types of headgear frames, shaft fittings, guides, Pit top and pit bottom arrangements, keps, suspension gear, types of drums, drum and skip winding, Cage winding and Friction (Keope Winding) speed control and safety contrivances.   Breaks, types, speed control methods, mining cables-classification, types, constructional details-cable jointing, care and maintenance.

UNIT X:
MINING LEGISLATION, MINE MANAGEMENT AND QUALITY CONTROL:
Mines-Act, Mine-Rules and regulations provisions of Mine Act in respect of drinking water, Health, Hygiene, etc., Medical facilities. Limitations of employment, leave with wages, etc., Coal Mines/Metal Mines Regulations - Definitions duties of manager, over man, safety officer, under manager etc., Transport, Mine working ventilation etc., Precautions against Dangers from fire, dust gas, water etc., Mine lighting and safety equipment and fences, Indian electricity rules-notices- plans-lighting, communications fire precautions, transformer, protective equipment ear thing, voltage limits signaling haulage, earthling, super vision exemptions   Industrial Dispute Act and total quality management   Causes disputes work committee, strikes, lock out- definition of TQM, ISO9000 Series-merits, drawbacks, Indian standard quality system, ISO environmental standards, Mine Management-Role of mining industry-Organization structure, Entrepreneurship and organizational structures –motivation factors, risk, rewards, requirements ,product selection, site selection ,theory of motivation leadership ,decision making communication process, market survey demand survey, techno economic,   break even analysis- recruitments and training ,methods ,essential quality of persons –training as per V.T.C rules training programs ,Network analysis – definition- objectives-construction of networks-merits and demerits of CPM, simple problems on CPM.

PERT definition methodology time estimation simple problems comparison between CPM vs PERT, salvage operation application in mind, importance of vocational training to miners – purpose–scope-VT centers-applicability –courses, equipment, selection of training officers duties and responsibilities, Causes and prevention of different accidents in mines etc, safety in mines-safe, unsafe conditions, importance of safety measures, pit safety committee, role of safety conferences, role of CMRS in safety promotions, Role of DGMS in for safety mines ,safety organization, standards of lighting ventilation etc.

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TS ECET-2019

MODEL QUESTIONS FOR MINING ENGINEERING

MATHEMATICS

1. If ω is a cube root of unity then $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} =$

   1) 0   2) 1   3) -1   4) 2

2. If $\frac{2x+5}{(x+1)^4} = \frac{A}{(x+1)^5} + \frac{B}{(x+1)^4}$ Than (A,B)=

   1) (1,2)   2) (1,3)   3) (2,3)   4) (2,4)

3. Tan-1(1/2) + Tan-1(1/3) =

   1) 0   2) $\frac{\pi}{3}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{4}$

4. $\int_0^{\frac{\pi}{2}} \log(\cot x)\,dx =$

   1) 1   2) 0   3) 2log2   4) None

5. The differential equation $\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$ is called

   1) Homogenous   2) Linear   3) Exact   4) None

PHYSICS

1) Dimensional formula for stress

   1) ML2T-3   2) ML-T-2   3) ML0T-2   4) MLT-1

2) On which principle optical fiber works

1) Reflection   2) Refraction   3) Total internal reflection   4) Total internal refraction

3) Relation between centigrade and Kelvin scale of temperature

1) T=t+273   2) T=t-273   3) t=T+273   4) t=T-273

4) Find the dot product of two vectors
A=2i+3j+4k and B=4i-2j+3k

1) 26   2) 14   3) 22   4)0

5) A work done by a man in carrying a load of 60 Kg over his head when he travels a distance of 5m in horizontal direction is (g=9.8 m/s2)

1) 2940 J   2) 0J   3) 2940m   4) 300J

CHEMISTRY

1. The Oxidation number of Mn in MnO^-_4 is

1) +5   2) +6   3) +7   4) +4

2. The molarity of 10% NaOH solution is

1) 0.025   2) 0.25   3) 2.5   4) 25

3. Galvanic cells are the cells which convert

1) Electrical energy to chemical energy   2) Chemical energy to electrical energy
3) Chemical energy to Mechanical energy   4) Potential energy to Kinetic energy

4. The exhausted cation exchange resin can be regenerated by using

1) NaCl   2) NaOH   3) HCl   4) NH_3

5. Which of the following is not a lew is base

1) H_2O 2) BF_3 3) NH_3 4) CH_3OH

MINING ENGINEERING

1.   Recaping to be done once in

        1) 6 months   2) 12 months   3) 3 months   4) 4 months

2.   Normal Height of manhole:

        1)1.2 meters   2)1.8 meters   3)1.5 meters   4) 2 meters

3.   Roadway driven in coal mine called:

        1) Stook   2) split   3) Heading   4) Gallery

4.   Maximum height of the roadway permitted by law

        1) 1.5 meters   2) 1.8 meters   3)2.4 meters   4) 3 meters