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**PRACTICALS / SESSIONALS**

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**Credits (Practicals/Sessionals)**

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**TOTAL SEMESTER CREDITS**

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Module-I (18 hours)
Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge’s method, Second order partial differential equation The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II (12 hours)
Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping, Complex integration: Line integral in the complex plane, Cauchy’s integral theorem, Cauchy’s integral formula, Derivatives of analytic functions

Module –III (10 hours)
Power Series, Taylor’s series, Laurent’s series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:
   Reading Chapters: 11,12(except 12.10),13,14,15
   Reading chapter: 18

Reference books:
Module I   (13 Lectures)
Introduction: Scope of fluid mechanics and its development as a science
Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface
tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.
Fluid statics: Pressure, Pascal’s Law, Pressure variation for incompressible fluid,
atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer.

Hydrostatic process on submerged surface, force on a horizontal submerged plane surface,
force on a vertical submerged plane surface.
Buoyancy and floatation, Archimedes’ principle, stability of immersed and floating bodies,
determination of metacentric height.

Fluid kinematics: Introduction, description of fluid flow, classification of fluid flow. Reynold’s
number, Acceleration of fluid particles, flow rate and continuity equation, differential equation
of continuity,
Mathematical definitions of irrotational and rotational motion. Circulation, potential function
and stream function. Flow net

Module II   (12 Lectures)
Fluid dynamics: Introduction, Euler’s equation along a streamline, energy equation, Bernoulli’s
equation and its application to siphon, venturimeter, orificometer, pitot tube.

Flow in pipes and ducts: Loss due to friction, Minor energy losses in pipes Hydraulic Gradient Line
(HGL), Total Energy Line (TEL), Power transmission in the fluid flow in pipes, fluid flow in pipes in
series and parallel. Flow through nozzles.

Module III  (15 Lectures)
Hydraulic turbine: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine.
Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and
performance curves.
Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance
curve. Function of draft tube and casing cavitation
Centrifugal Pump: constructional features, vane shape, velocity triangles, Efficiencies, Multi stage
centrifugal pumps, Pump Characteristic, NPSH and Cavitation.

Positive displacement pumps: Reciprocating Pump, Working principle, Discharge, work done and
power requirement, Slip, Indicator diagram

Text Books
1. Fluid Mechanics and Hydraulic Machines, Modi & Seth
2. Introduction to Fluid Mechanics and Fluid Machines by S.K. Som and G. Biswas, TMH

Reference Books:
1. Fluid Mechanics by A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics by Fox, McDonald, Willey Publications
3. Fluid Mechanics by Kundu, Elsevier
4. An Introduction to Fluid Dynamics by G.K.Batchelor, Cambridge University Press
5. Engineering Fluid Mechanics by Garde et. al., Scitech
6. First course in Fluid Mechanics by Narasimhan, University press
PCME4202   Mechanics of Solids

MODULE - I (14 Lectures)
2. Members in Biaxial State of Stress: Stresses in thin cylinders, thin spherical shells under internal pressure - wire winding of thin cylinders. Analysis of Biaxial Stress. Plane stress, Principal stress, Principal plane, Mohr's Circle for Biaxial Stress.
3. Strain Deformation: Two dimensional state of strain, Mohr's circle for strain, Principal strains and principal axes of strain measurements, Calculation of principal stresses from principal strains.

MODULE - II (13 Lectures)
5. Simple Bending of Beams: Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, beams of two materials, Composite beams.
6. Deflection of Beams: Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method.

MODULE - III (12 Lectures)
8. Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Stresses due to combined bending and torsion, Strength of shafts in combined bending and twisting.

TEXT BOOKS
3. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning

REFERENCE BOOKS
7. Strength of Materials by R.Subramaniam, Oxford University Press
BECS2212 C++ & Object Oriented Programming

Module I (08 hrs)
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II (16 hrs)
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references. Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors. Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes. Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III (08 hrs)
Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor. Template: template classes, template functions. Namespaces: user defined namespaces, namespaces provided by library.

Text Books:
1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:
1. Big C++ - Wiley India
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)
Module-I: (12 hours)


Module-II: (12 hours)


Module-III: (12 hours)

Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)

Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:


Reference Books:

4. Gupta, “ Managerial Economics”, TMH
5. Lal and Srivastav, “ Cost Accounting”, TMH
HSSM 3205 Organizational Behaviour

Module I:
The study of Organizational Behaviour: Definition and Meaning, Why Study OB
Learning – Nature of Learning, How Learning occurs, Learning and OB.
Foundations of Individual Behaviour: Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.
Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB.
Motivation – Nature and Importance, Herzberg’s Two Factor Theory, Maslow’s Need Hierarchy Theory, Alderfer’s ERG Theory, Evaluations.

Module II:

Module III:

Text Books:

Reference Books:
1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
Module I

Module II
Compass Surveying – Uses of prismatic compass, temporary adjustment, bearing of a line, local attractions, correction of bearing.
Plane table surveying- Methods of plane table, radiations, intersection, traversing and resection, 2-point and 3-point problem.
Use of Mining type theodolite, Measurement of horizontal and vertical angles.

Module III
Levelling – use of dumpy level and levelling staff. Temporary and permanent adjustment of dumpy level. Reduction of levels by HI and rise & fall method. Error due to curvature & refraction. Sensitiveness of bubble tube, reciprocal levelling, levelling difficulties and common errors.

Books Recommended:
2) Surveying- Vol.I, by B.C. Purmia
3) Surveying – by Husain & Nagnas.
This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain.

Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization
   i. Preparing job-applications and CVs
   ii. Facing an interview
   iii. Participating in group discussion (as part of the recruitment process)

2. In-house communication
   a. Superior/ Senior ➔ subordinate / junior (individual ➔ individual / group)
      i. Welcoming new entrants to the organization, introducing the workplace culture etc.
      ii. Briefing subordinates / juniors: explaining duties and responsibilities etc.
      iii. Motivating subordinates / juniors (‘pep talk’)
      iv. Instructing/ directing subordinates/ juniors
      v. Expressing / recording appreciation, praising / rewarding a subordinate or junior
      v. Reprimanding / correcting / disciplining a subordinate/junior (for a lapse) ; asking for an explanation etc.
   b. Subordinate / Junior ➔ Superior / Senior
      i. Responding to the above
      ii. Reporting problems / difficulties / deficiencies
      iii. Offering suggestions
BECS7212  **C++ & Object Oriented Programming Lab**

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using static polymorphism.(1 class)
4. Programs on dynamic polymorphism.(1 class)
5. Programs on operator overloading.(1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator.(1 class)
8. Programs on exception handling .(1 class)
9. Programs on generic programming using template function & template class.(1 class)
10. Programs on file handling.(1 class)

PCMN7201 **Mine Survey – 1 Lab**

1. Testing of chain and measurement of correct length of the line.
2. Traversing by chain survey.
3. Traversing by Compass survey.
5. Traversing by plane table.
6. Use of dumpy level and fly levelling.
7. Longitudinal Section and Cross Section of Road.
8. Contouring
10. Traversing by theodolite.
4th Semester

PCME4207 Machine Dynamics (3-0-0)

MODULE – I (12 Hours)
1. Mechanisms: Basic Kinematic concepts and definitions, Mechanism, Link, Kinematic Pair, Classification of kinematic pairs, Degrees of freedom, Kinematic chain, Binary Ternary and Quaternary joints and links, Degrees of freedom for plane mechanism, Grubler’s Equation, Inversion of mechanism, Four bar chains and their inversions, Single slider crank chain, Double slider crank chain and their inversion.
   Acceleration Diagram for a slider – crank mechanism, Corili’s component of acceleration and its application.

MODULE – II (12 Hours)
3. Inertia forces in reciprocating Parts: Velocity and acceleration of piston by analytical method, Angular velocity and angular acceleration of connecting rod by analytical method and by graphical method, Piston effort, force acting along the connecting rod, Crank effort, Turning moment on crank – shaft.
4. Dynamically equivalent system, compound Pendulum, correction couple.
   Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed.
5. Friction of a screw and nut, Square threaded screw, V-threaded screw, Pivot and collar friction, friction circle, Friction axis, Friction clutches, Transmission of power by single plate, multiplate and cone clutches.

MODULE – III (12 Hours)
   Absorbing and transmission dynamometers, Prony brake, Rope brake, Band brake dynamometer, Belt transmission dynamometer, Torsion dynamometer.
8. Belt, rope and chain drives, Initial tension, Effect of centrifugal tension on power transmission, Maximum power transmission capacity, Belt creep and slip.

TEXT BOOKS
L.A Textbook of Theory of Machines (In S. I. units) – R. K. Bansal, Laxmi Publication
Chapter: 1, 3, 4, 7, 8, 10, 11, 12.

REFERENCE BOOKS:
L. The Theory of Machines – Thomas Bevan.
BEEE7215 Energy Conversion Techniques

MODULE- I (10 Hrs)
1. DC GENERATORS: Constructional features and operating principles, EMF equation, No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses and Efficiency.

2. DC MOTORS: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, Starting, Speed control and application of DC motor.

MODULE- II (10 Hrs)
3. SINGLE PHASE TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, Open Circuit Test and Short Circuit Test, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase Transformers Connected as a Bank of Three Phase Transformer.

4. INDUCTION MOTORS: (a) Three Phase Induction Motors: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors.
(b) Introduction to Single Phase Induction Motors: Construction, Principle of Operation and Application.

MODULE- III (10 Hrs)
5. THREE PHASE SYNCHRONOUS GENERATORS: Constructional Features, Principle of operation as Alternator, Synchronous reactance, Equivalent circuit of alternator, Power-Angle curve, Synchronization of alternators.


Text Book :

Reference Book(s):
2. The Performance and Design of DC Machines – A E Clayton.
3. Theory and Performance of AC Machines – M G Say
8. Electric Machines – Charles Hubert – Pearson Education.
Module I : (10 hours)  
Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II : (12 hours)  
Relation Query Languages, Relational Algebra and Relational Calculus, SQL.  
Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.  
Query Processing Strategy.

Module III: (10 hours)  
Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

Text Books:  
1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education)  
2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

References Books:  
(1) An introduction to Database System – Bipin Desai, Galgotia Publications  
(2) Database System: concept, Design & Application by S.K.Singh (Pearson Education)  
(3) Database management system by leon &leon (Vikas publishing House).  
(4) Fundamentals of Database Management System – Gillenson, Wiley India  
Module I           14 hours
Physical Geology:
Introduction, weathering, erosion, transportation, deposition, Geological action of wind, river,
glacier and underground water, Earth quakes and volcanoes.
Structural Geology:
Elementary knowledge of rock deformation, structural characteristics of deformed rocks,
attitude of rock beds strike, dip: true and apparent, folds and faults, their description,
classification, joints, un-conformities, simple forms of igneous rocks, dykes, sills, batholiths,
laccoliths, Iropolithis, phacoliths.

Module II           16 hours
Mineralogy: Crystals, Axial relationship, symmetry elements and forms of normal classes of
cubic Tetragonal, Hexagonal, Orthorhombic, monoclinic and Triclinic, Minerals and their
physical properties determinative properties and occurrence of common rock forming
minerals, Quartz orthoclase, muscovite, bio tite, Olivine, augite, hornblende, Calcite,
dolomite, beryl, tourmaline.
Petrology: General characters of igneous, sedimentary and metamorphic rocks; Description
of rocks Viz; granite, diorite, gabbro, dunite, peridofite, peg matite, dolerite, basalt,
conglomerate, sand stone, shale, lime stone, quartzite, marble, slate, schist, gneiss,
Khondalite and their Indian occurrence.

Module III           6 hours
Engineering Geology: Geological considerations in connection with-
   a) Dam and associated reservoirs
   b) Tunnels
   c) Bridges
   d) Ground water.

Text Books:
   1. Text Book of Geology – P.K.Mukherjee
   2. General and Engineering Geology- Parvin Singh
   3. Text Book of Geology- G.B. Mahapatra

Reference Books:
   1. Element of Petrology-Tyrell
   2. Structural Geology- Marland P. Billings
   3. Ruffles Elements of Mineralogy- H.H.Reid
   4. Physical Geology – Sainder Singh
PCMN4203 **Mine Development**

**Module I**
Exploratory drilling and blast hole drilling: Different types of exploratory drills and methods of core recovery, different types of drills bits used. Different types of drills machines used for blastholes and methods of drilling.

**Module II**

**Module III**

Books recommended:
1) Surface Mining – Dr. G.B.Mishra
2) Blasting Manual – Sandhu & Pradhan
3) EMT volume – 1
4) SME Hand Book

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**BEC7208 Database Managements System Lab**

1. Use of SQL syntax: insertion, deletion, join, updation using SQL. (1 class)
2. Programs on join statements and SQL queries including where clause. (1 class)
3. Programs on procedures and functions. (1 class)
4. Programs on database triggers. (1 class)
5. Programs on packages. (1 class)
6. Programs on data recovery using check point technique. (1 class)
7. Concurrency control problem using lock operations. (1 class)
8. Programs on ODBC using either VB or VC++. (1 class)
9. Programs on JDBC. (1 class)
10. Programs on embedded SQL using C / C++ as host language. (1 class)
BEEE7215 Energy Conversion Techniques Lab

Select any 8 experiments from the list of 10 experiments

1. Determination of critical resistance and critical speed from no load test of a DC shunt generator.
2. Plotting of external and internal characteristics of a DC shunt generator.
3. Starting of DC shunt motors by 3-point/4-point starter.
4. Speed control of DC shunt motor by armature control and flux control method.
5. Determination of Efficiency by Open Circuit and Short Circuit test on single phase transformer.
6. Polarity test and Parallel operation of two single phase transformers.
7. Open circuit and Short circuit test of an alternator.
8. Load test of three phase induction motors.
10. Starting of single phase induction motors

PCMN7202 Geology Lab

The student will have to go for four weekends for geological tour besides sessional/practical classes in 3rd semester.
   1) Study of Physical properties of minerals.
   2) Study of important igneous sedimentary and metamorphic rocks.
   3) Interpretation of folds and faults from maps.

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<td>PCMN4301</td>
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Module – I

Module – II
(b) Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

Module – III

Text Book :
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack

Reference Books
1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
3. Environmental Science, Curreingham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
HSSM3302 OPTIMIZATION IN ENGINEERING (3-0-0)

Module-I (10 Hours)
Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

**Linear programming:** Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

Module-II (10 Hours)

**Transportation problems:** Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel’s approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

**Assignment problems:** Hungarian method for solution of Assignment problems

**Integer Programming:** Branch and Bound algorithm for solution of integer Programming Problems

**Queuing models:** General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module-III (10 Hours)

**Non-linear programming:** Introduction to non-linear programming.

**Unconstraint optimization:** Fibonacci and Golden Section Search method.

**Constrained optimization with equality constraint:** Lagrange multiplier, Projected gradient method

**Constrained optimization with inequality constraint:** Kuhn-Tucker condition, Quadratic programming

Introduction to Genetic Algorithm.

Recommended text books

Recommended Reference books:
PCMN4304 **SURFACE MINING** (3-0-0)

**Module-I**
Development of Mineral Deposit by open cast method factors affecting for choice of open cast method advantage and disadvantages. Drilling, blasting, loading and transportation in open cast mines, method of stripping, bench parameters, Equipment used for different operations, choice and application (21 hrs)

**Module-II**
Planning and design of surface mining operations with single bucket excavators, shovel and dragline, ultimate pit configuration, Development of face geometry for B.W.E. continuous surface miners, simulation of surface mining operations and transportation, productivity calculation. (18 hrs)

**Module-III**
Placer mining and Sea-bed mining, Environmental problems in Surface mining. (9 hrs)

**Books**:
1. Surface Mining by Dr. G. B. Mishra
2. Mining of Mineral Deposit by Dr. L. Shevyakov
3. Surface Mining by Dr. S. K. Das.
4. EMT Vol. I by Dr. D. J. Desmukh
5. Winning coal and iron ore by Dr. Deshmukh & Deshmukh.

PCMN4303 **UNDER GROUND COAL MINING** (3-0-0)

**Module-I**
Coal Mining: Selection of mining methods, classification of method of coal mining. Pillar Mining Method: Panel system of working, incubation, period, Relation between depth of deposit & size of pillar, percentage of extraction, Man- power calculation, Productivity calculation, Application, development & extraction by B&P Method of mining, Depillaring. (15 hours)

**Module-II**
Long wall Mining Method: Classification, Application on Development and extraction, face mechanization, Power support. (10 hours)

**Module- III**
Horizon Mining, Contiguous Mining.. Application & Layout (10 hours)

**BOOKS RECOMMENDED**:
1. EMT Volume -1
2. Coal Mining: Principles and practices of modern coal mining, New age international 1st Ed, 1997 by R.D.Singh
PCMN4301 MINE MACHINERY (3-0-0)

Module-1:
Prime mover for mining machinery, I.C. Engine, Hydraulic power Pneumatic power, Element of mechanical power transmission gears, coupling, clutch and brake. (12 hrs)

Module-II
Wire rope and winding system, Mine hoist: Different types of winders, their constructional features, kinematics, torque and power calculation, speed control, safety devices, cage, skip head gear structure, cage guide, shaft fittings, Man riding system in mines. (18 hrs)

Module-III
Belt conveyors, rope haulage, chain conveyor and locomotive their constructional features, power calculation and safety appliances. Mine pump and drainage. (15 hrs)

BOOKS:
1. Mine Transport by L. T. Kerelin
2. EMT Volume III by D. J. Desmukh

PCMN4302 MINE CLIMATE AND VENTILATION (3-0-0)

Module-I
Thermal Environment & Psychrometry,: Sources of heat load sources in mines. Effect of heat and humidity on miners. Psychrometry, Cooling power of mine air, Methods of improving of cooling power of mine air, Air conditioning- basic vapour cycle: Mechanics of air flow through mine openings Resistances of airways, Equivalent orifice, distribution of air current control devices in ventilation system. Sampling dust & dust diseases. (15 hrs)

Module-II
Natural Ventilation Calculation of NVP, Thermodynamics aspects, Artificial aids to natural ventilation. Mechanical Ventilation Principal types of mine fans, Installation, Operation, Characteristics and selection of mine fans, Fan testing and Output Control, Fan laws and fan drives, Evasees, Diffusers, Booster fans, Auxiliary ventilation Reversal of currents and controlled recirculation. (23 hrs)

Module-III

BOOKS:
FEML6302  **MINING GEOLOGY** (3-0-0)

**Module-I  (12 hrs)**

**Module-II  (15 hrs)**
Mineralogy, mode of occurrence, distribution and commercial uses of important Mineral deposits of India i.e. Iron, Chromite, Buxite, Manganese, Copper, Lead- Zinc, Industrial mineral- Mica, Gypsum, Kyanite, Limestone.

**Module-III  (18 hrs)**
Mine Sampling, Estimation of ore reserves and grades, tenor, impurities and quality control.
Engineering Geology: Geological considerations in connection with -
1. Dam and associated reservoirs
2. Tunnels.
3. Bridges.
4. Ground water.

**BOOKS:**

FESM6301  **NUERICAL METHODS** (3-0-0)

**Unit –I  (10 hrs)**
Approximation of numbers, Significant figures, Accuracy and precision, Error definition, Round off errors, Error propagation, Total numerical error
Roots of equation: Bisection ethos, False-position method, Fixed point iteration, Newton-Raphson method, Secant method, Convergence and error analysis, System of non-linear equations
Linear algebraic equation: LU decomposition, The matrix inversion, Error analysis and system conditions, Gauss-Siedel method

**Unit-II  (10 hours)**
Interpolation: Newton’s divided difference interpolating polynomial, Lagrange interpolating polynomial, Spline interpolation.
Numerical integration: The Trapezoidal rule, Simpson’s rule, Newton-Cotes algorithm for equations, Romberg integration, Gauss quadrature

**Unit-III  (10 Hours)**
Ordinary differential equation: Euler method, Improvement of Euler’s method, Runge-Kutta methods, System of equations, Multi step methods,
General methods for boundary value problems, Eigen value problems
(Algorithm and error analysis of all methods are included )

**Text Book:**
   Publication.

**Reference Books**
PCMNN7301 MINE MACHINERY LAB (0-0-3)

1. Model study of Direct rope haulage, Main & Tail rope haulage, Endless rope haulage, Endless rope haulage.
2. Model study of Belt conveyor, Chain conveyor, Shaker conveyor.
3. Study of King- detaching safety hook.
4. Study of rope capeling.
5. Study of Rope splicing.
6. Study of head gear structure.
7. Study of cage guide
8. Study of shaft fittings(cage fittings)
9. Study of centrifugal pump, turbine pump & mono pump.

PCMNN7302 MINE CLIMATE & VENTILATION LAB. (0-0-3)

1. Determination of relative humidity of mine air using massion and whirling hygrometer.
2. Determination of dust concentration by G.D.S.
3. Determination of dust concentration by conimeter.
4. Determination of cooling power of mine air using Kata Thermometer.
5. Measurement of fan pressure.
6. Plotting of fan characteristic curve.
7. Plotting of dust characteristic curve.
8. Model study of centrifugal fan with reversal arrangement, Axial flow fan.

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6th Semester

PCMN4305 MINE SURVEYING – II (3-1-0)

Module - I:

Module-II:
Special mine surveys-survey of installations of Mine, EDM & Its Application, GPS ,total station, surveys for connecting National grid.

Module-III:
Elements of Photogrammetry, field astronomy: Principles & Definitions, Determination of true meridian, Latitude, longitude & time.

Books Recommended :
1. Mine Surveying by Mason
2. Surveying by B.C. Punimia
3. Plane & Geodetic Surveying by David Clarke

PCMN4307 UNDERGROUND METAL MINING METHODS (3-0-0)

Module - I:
Classification and choice of stoping methods, Methods of stoping: open stoping, Supported stoping – breast, underhand and overhand stoping, shrinkage stoping, cut and fill stoping method, sub-level stoping.

Module - II:
Introduction to caving methods: top slicing, sub-level caving, block caving.

Module - III:
Stope mechanization and level interval. Techno-economic analysis on choice of stoping methods, high productivity methods.
PCMN 4308 ROCK MECHANICS & GROUND CONTROL (3-1-0)

Module - I:
Physico-mechanical properties of rocks, elastic & time dependent behavior, Rock mass failure, stress analysis, in-situ stresses & stress distribution around mine openings; ground failure & pressure on supports, stability of wide openings; design of supports in mine openings.

Module - II:
Subsidence: Causes & impact of subsidence, mechanics of surface subsidence, discontinuous & continuous subsidence, monitoring prediction, control & management of subsidence.

Module - III:

Books Recommended:
1. Rock Mechanics & Ground control by Dr. B.S. Verma
2. Rock Mechanics by overl & Dual
3. S. M. E.
4. Coal Mine & ground control by s. Peng

FEMN6301 ELECTRICAL EQUIPMENT IN MINES (3-0-0)

Module-I:
Mine power supply: Choice of voltage, surface and underground supply: Tariff Computation: Mine Cables- Construction, installation, fault location, Gate-end boxes and switch gears, Earthing Methods, protective devices, overload, under-voltage earth leakage, D.C. Supply- rectifiers, storage batteries.

Module-II:
Electrical Equipment: Mining transformer, lighting transformer, A.C. and D.C. Motors speed-torque characteristics, starting, braking, speed control, drives for haulage, ventilation fans, pumps, compressors, electrical locomotives, winders, Introduction to thyristor device, flame proof and intrinsic safety.

Module-III:
Control and instrumentation: Open and closed loop system, remote control, sequence control, winder control of open cast mine equipment, sensor for measurement of various operational, environmental and safety parameters in underground and open cast mines. Communication and data transmission: Mine telephone system, signaling system, LAN.

Books recommended:
1. Electrical equipment in Mines by H.Cotton.
PCML4304 MATERIAL HANDLING SYSTEMS (3-0-0)

Module - I:
Property of bulk material vis-a-vis different bulk handling operation. classification of bulk material transportation systems.

Module - II:

Module - III:

PCMN6301 MINE HAZARDS (3-0-0)

Module - I:
Mine gases: properties, physiological effects, occurrence, detection, and monitoring; Degassification of coal seams; Sampling and analysis of mine atmosphere;

Module - II:
Mine fires, Explosions from firedamp and coal dust.

Module - III:
Rescue and recovery; Inundation of mines and dewatering; Mine illumination, Noise and radiation hazards.

PCMN7305 MINE SURVEYING - II LAB

1. Triangulation survey.
2. Testing of verticality of shaft.
3. Curve setting.
4. Application of EDM, GPS & Total station.
5. Determination of True North.
6. Determination of latitude, Longitude & time of a place.
7. Survey camp for 2 weeks duration.
PCMN7307 ROCK MECHANICS & GROUND CONTROL LAB

1. Preparation of rock sample.
2. Determination of uniaxial tensile strength by braillian method.
3. Determination of point load index of given sample.
4. To determination of point load index of given sample
5. To determine the strength index of supplied specimen by impact strength index (ISI) Appartus.
6. Determination of uniaxial compressive strength by uniaxial compressive testing machine.
10. Determination of Shear strength of Rock Sample or Soil.

PCMN7306 MINE HAZARDS LAB ( 0-0-3)

1. Determination of CO, CO₂ ,CH₄, and O₂ in mine air.
4. Determination of constituents of coal by proximate analysis.
5. Determination of CPT of coal samples.
6. Determination of inflammabiliy of coal dust using Godbert-Greenwald apparatus..
7. Study of operation of gas mask and self rescuers.
8. Study of operation of BG-174/BG4 SCBA.
10. Measuring Leq and noise dose using sound level meters and noise dosimeter.

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# BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

## MINING ENGINEERING

### 7th Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subjects</th>
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<tr>
<td>HSSM3401</td>
<td>Entrepreneurship Development</td>
<td>3-0-0</td>
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<tr>
<td>PCMN4401</td>
<td>Mine Legislation &amp; Safety</td>
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<td>FEMN6401</td>
<td>Mineral Beneficiation</td>
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<td>FEMN6402</td>
<td>Coal Beneficiation</td>
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<td><strong>Professional Elective-I (Any one)</strong></td>
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<td>PEMN5401</td>
<td>Advanced Underground Coal Mining</td>
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<td>Advanced Underground Metalliferous Mining</td>
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<td>PEMN5403</td>
<td>Advanced Surface Mining</td>
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<td><strong>Professional Elective-II (Any one)</strong></td>
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<td>PEMN5404</td>
<td>Computer Applications in Mining</td>
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<td>PEMN5405</td>
<td>Computational Geomechanics</td>
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**Theory Credits** 16

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<th>Practical/Sessional</th>
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<tr>
<td>PCMN7401 Industrial Training (Training to be taken after 6th Semester during Summer Vacation)</td>
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<tr>
<td>FEMN7401 Mineral Beneficiation LAB</td>
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<td>FEMN7402 Coal Beneficiation LAB</td>
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<td>PCMN7402 Project</td>
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**Practical / Sessional Credits** 07

### 8th Semester

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<td>Mine Planning</td>
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<td>PEMN5407</td>
<td>Small Scale &amp; Dimensional Stone Mining</td>
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<td>FEMN6403</td>
<td>GIS &amp; Remote Sensing</td>
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<td>PEMN5408</td>
<td>Satellite Communication Systems</td>
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<td>FEMN6404</td>
<td>Geostatistics</td>
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<td>PEMN5409</td>
<td>Internet Technology &amp; Applications</td>
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**Theory Credits** 12

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<tr>
<td>PCMN7405 Comprehensive Viva-Voce</td>
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<tr>
<td>PCMN7406 Seminar</td>
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**Practical / Sessional Credits** 11

**TOTAL SEMESTER CREDITS** 23

**TOTAL CUMULATIVE CREDITS**
Module I: Understanding Entrepreneurship
Concept of Entrepreneurship, Motivation for Economic Development and Entrepreneurial Achievement, Enterprise and Society
Why and how to start Business – Entrepreneurial traits and skills, Mind Vrs Money in Commencing New Ventures, Entrepreneurial success and failures, Environmental dynamics and change.

Entrepreneurial Process
Step by step approach to entrepreneurial start up
Decision for Entrepreneurial start up.

Module II: Setting up of a small Business Enterprise.
Identifying the Business opportunity - Business opportunities in various sectors, formalities for setting up small enterprises in manufacturing and services, Environmental pollution and allied regulatory and non-regulatory clearances for new venture promotion in SME sector.
Writing a Business plan, components of a B-Plan, determining Bankability of the project.

Module III: Institutional Support for SME.
Central / State level Institution promoting SME.
Financial Management in small business.
Marketing Management, problems & strategies
Problems of HRM – Relevant Labour – laws.

Sickness in Small Enterprises.
Causes and symptoms of sickness – cures of sickness.
Govt. policies on revival of sickness and remedial measures.

Reference Books:
2. Entrepreneurial Development, S.S. Khanka, S Chand
3. Entrepreneurship, Barringer BR, Ireland R.D., Pearson
4. Entrepreneurship, David H Holt, PHI
5. Entrepreneurship, Kurilko, D.F. and Attodgets RM, Cengage
6. The Dynamics of Entrepreneurial Development & Management, Vasant Desai, HPH.
7. Entrepreneurship, Roy, Oxford
8. Entrepreneurship, Hisrich, Peters, Shepherd, TMH
MINE LEGISLATION AND SAFETY (3-1-0)

Objective:
To give the under graduate students an insight in to legislation related to safety and welfare of the personnel engaged in mining as well as the legislation related to the mineral laws for concession and conservation of the irreplaceable mineral reserves. It does not include the provisions of environmental law which is covered separately

Module I
Provisions of the Mines Act and the rules made there under, viz., the Mines Rules, Mine Vocational Training Rules, Mine Rescue Rules, Mine Crèche Rules and Indian Electricity Rules (selected chapters applicable to mining).
Introduction to Mine Safety – Mines accident reports, records and analysis. (12 hours)

Module II
Coal Mines Regulations. Metalliferous Mines Regulations. Important circulars of DGMS. Important Bye-laws and standing orders. Recommendations of various mine safety conferences. (12 hours)

Module III
Laws related to off shore Mining and restrictions on the setting up of mining operations or processing etc. in the said Coastal Regulation Zone (CRZ) coastal zone. Overview of the other laws applicable to mining. (12 hours)

Text Books: (Government publications)
1. Mines Act
2. Mines Rules
3. Mine Vocational Training Rules
4. Mine Rescue Rules
5. Coal Mines Regulations
6. Metalliferous Mines Regulations
7. Mines and Minerals (Regulation and Development ) Act
8. Mineral Concession Rules
9. Mining Lease Rules
11. Off shore Area Minerals (Development and Regulation) Act

References Parts applicable to mining only (Government publications)
1. Indian Electricity Rules
2. Workmen’s Compensation Act
3. Industrial Disputes Act (Selected parts)
4. Indian Explosive Rules
5. Mines Crèche Rules
6. Industrial Disputes Act
7. Trade union Act
MINERAL BENEFICIATION

Objective
With the progressive depletion of the high grade mineral deposits and the corresponding lowering of the cut of grades for mining, it is desirable that the mining engineers should be familiar with the beneficiation methods. This course aims at such a familiarization so as to enable the graduate mining engineers to supervise the beneficiation plants attached to the mines.

Module I  12 hours
Size analysis of minerals. Laboratory sizing. Testing sieves of Indian standards and other standards used internationally such as BSS, Tyler series, ASTM sieves and IMM series. Differential and cumulative size distributions and plots. Size distribution equations. Industrial screens: their design, selection and operations. Sub sieve sizing. Newton’s and Stoke’s laws for settling of particles. Free and hindered settling. Design, selection and operation of hydraulic and mechanical classifiers such as Akin’s spiral Classifier, Dorr rake classifier, rake and bowl classifier etc. Hydro cyclones and Pneumatic cyclones used for classification of minerals. Partition value curves for screens and classifiers.

Module II  12 hours
Liberation studies and their importance. Role of size reduction in mineral beneficiation. Operational features of different types of crushers such as jaw, gyratory, cone and short head cone crushers, rotary breakers, roll crushers, hammer mills and stamp mills. Principles of tumbling mills. Construction, selection and operation of pebble mills, rod mills and ball mills including tube mills and Hardginge mills. Autogenous and semiautogenous grinding. Kick’s, Ritinger’s and Bond’s laws on energy requirements for size reduction. Open circuit and closed circuit operations in size reduction. Effects of circulating loads.

Module III  12 hours
Principles of density separation of minerals. Dense media separators, dense media cyclones, different types of jigs, spiral concentrators, vibrating tables, cone and tray concentrators, pans, corduories and winnows for mineral concentration. Electrical separation in High Tension rolls, plate and screen plate separators. Different types of dry and wet magnetic separators of low, medium and high intensity. Overview of the surface phenomena and froth flotation of minerals. Rougher, scavenger, cleaner and recleaner operations in mineral beneficiation processes. Dewatering and drying: thickening and filtration.

Text Books:
4. Ore Dressing by R.H.Richards (4 volumes) – Engineering & Mining Journal 1909

References:
COAL BENEFICIATION

Objective:
With the progressive depletion of all the low ash coal deposits and the need of almost all the mined coal to be beneficiated, it is desirable that the mining engineers should be familiar with the coal beneficiation methods. This course aims at such a familiarization so as to enable the graduate mining engineers to supervise the coal beneficiation plants attached to the coal mines.

Module I
Overview of proximate analysis, ultimate analysis, calorific value, petrography and caking properties of coal. Crushing characteristics of coal and associated mineral matter. Rotary breakers, single and double roll crushers, hammer mills, impactors and other coal crushers. Differential breakage and partial deshaling in the coal crushing circuits. Types of screens for sizing of coal. Sink float tests and washability curves. Significance of NGM.

12 hours

Module II
Different equipment and methods for the beneficiation of coal: dense medium separators, coal jigs, dense medium cyclones, water only cyclones, Vorsyle separators, Larcodems and other coal beneficiation equipment, their selection and operation. Media recovery circuits for dense medium drums, baths and cyclones. Froth flotation of coal.

12 hours

Module III

12 hours

Text Books:
2. Coal preparation Technology by D.G. Osborne - Kluwer Academic Publishers, 101 Philip Drive, Norwell, MA 02061 (USA)

References:
1. Coal age operating handbook of coal preparation by Paul C. Merritt - Coal Age Mining Informational Services, 1978
2. Coal Preparation for Plant Operators Handbook by South African Coal Processing Society
3. Proceedings of International Coal Preparation Congress 2010 - Edited by Rick Q. Honaker
ADVANCED UNDER GROUND COAL MINING

Objective:

For the students who have already studied underground coal mining, this course aims at familiarizing them with advanced methods for higher productivity and difficult mining conditions, as well as techniques to enhance recovery by minimizing mining losses. It is aimed in this course to familiarize the students with large-scale highly mechanized mining methods.

Module I

Module II
Mine back filling: materials and methods: mechanical, hydraulic and hydro-pneumatic. Face mechanization in winning, conveying and supporting systems, their selection and organization. Highwall mining. (12 hours)

Module III
Hydraulic mining of coal. Under ground gasification of coal. CBM and CMM in mines and their drainage techniques. Overview of coal mining industry in India. (12 hours)

Text Books:
1. SME Mining Engineering Handbook (2 Volume Set) by Peter Darling
2. Longwall mining by Syd.S.Peng - Department of Mining Engineering, West Virginia University, 2006

Reference:
1. Coal Age Operating Hand Book of Underground Mining Nicholas P. Choronis BCOA/0-A N77.1;1
ADVANCED UNDER GROUND METALLIFEROUS MINING

Objective:
For the students who have already studied under ground metalliferous mining, this course aims at familiarizing them with advanced methods for higher productivity and difficult mining conditions, as well as techniques to enhance recovery by minimizing mining losses. The students will learn about planning and scheduling of underground metalliferous mining, deep mining techniques and novel methods of mining.

Module I  (12 hours)
Responses of various types of rock masses to open stopes, filled stopes and caved stopes. techno-economic analysis on the choice of stoping methods. Mass production methods: Blast hole stoping method, vertical retreat method (VRM), underground bench blasting, cascade mining method and raise stoping method..

Module II  (12 hours)

Module III  (12 hours)
Stope design and production planning, scheduling. Methods of extraction of pillars. In situ leaching, bore hole mining, under sea mining. Overview of novel mining methods.

Text Books

References:
1. Elements of Mining by S.R.Lewis - Powell's Books (Portland, OR, U.S.A.)
ADVANCED SURFACE MINING

Objective:
This course aims at familiarizing the students who have already studied surface mining/opencast mining/open pit mining, them with advanced treatment of methods for higher productivity and mechanization under widely varied geo-mining conditions, as well as techniques to enhance recovery.

Module I
Ground preparation for surface mining: hill top deposits, deposits on plane ground. Latest developments on surface mining equipment: excavators, dozer – ripper, scraper, and ore hauling equipment. Design of large scale bench blasting: coal and non coal: cast blasting, coyote blasting, chamber blasting. (12 hours)

Module II

Module III

Text Books:
2. Open pit Mine Planning and Design by W.A.Hurstrulid & Mark Kuchta – Amazon Books

References:
2. Safety in opencast mining by N. V. Mel'nikov, M. M. Chesnokov – Alibris
COMPUTER APPLICATION IN MINING

Objective:
For undergraduate students who are familiar with the basics of mining engineering as well as the fundamentals of computer programming, this course aims at giving them an overview of how the software used in mining engineering works.

Module I
Overview of computer programming with reference to pseudo codes, C and C++ languages. Principles of plotting pixels and a brief introduction to lines and curves as orderly combinations of pixels. Coordinate system of plotting Mine Survey data and the use of computer graphics for such plotting. Overview of the common well known software packages like Surpac, Intellimine, Crystal etc. (12 hours)

Module II
Introduction to computer applications in rock mechanics and support design, blast design, prediction and assessment of blasting results, mine ventilation calculations, dispatch scheduling and other mining applications. Scope and limitations of networking mine offices, stores, work shops etc. to enhance productivity and cost control. (12 hours)

Module III
Application of System Simulation to study and solve mining problems. Modeling and simulation of mineral handling and mineral beneficiation systems. Overview of a few well known simulation packages to Mineral processing like JKSIMET, MODSIM etc. (12 hours)

Text Books:

References:
COMPUTATIONAL GEOMECHANICS (3-0-0)

Module-I
Principles of continuum mechanics, Transformation of vector and tensor, Analysis of stress and strain, Mohr’s circle of stress and strain in two dimensions, Stress Equilibrium Equation, Airy Stress Function, Strain Compatibility Conditions, Stress-strain Relationship, Linear Isotropic Elasticity, Degree of Anisotropy, Non-linear Elasticity, Plasticity. (14 hours)

Module-II
Basics of FEM/FDM/BEM, Discretization of physical system with finite element, Nodal Shape function, Concept of Calculus of Variations, Numerical integration scheme, Assembly into Global Simultaneous unreduced equation, Application of Essential boundary conditions, Determination of Strains, stress and Reaction forces, Tunnel Example. (14 hours)

Module-III
Rock and Rock mass failure criterion, Mohr-Coulomb yield criterion, Drucker-Prager criterion, Hoek-Brown criterion, Tensile Yield criterion, Analysis and design of structures and excavations in rocks-surface and underground, Strength and deformability of jointed rock mass. (8 hours)

Suggested Books:

MINERAL BENEFICIATION LAB. (0-0-3)

Suggested list of experiments:
1. Physical examination and identification of minerals.
2. Crushing of ore/coal in a jaw crusher and to study the size analysis of the product.
3. To study the jaw crusher and determine the actual capacity and reduction ratio.
4. Verification of Rittinger’s Law of crushing in a jaw crusher.
5. Crushing of ore/coal in a roll crusher and to study the size analysis of the product.
6. Crushing of ore/coal in a gyratory crusher / pulveriser and to study the size analysis of the product.
7. Crushing of ore/coal in a cone crusher and to study the size analysis of the product.
8. To study the effect of grinding with grinding time in cylindrical ball mill and rod mill.
9. To separate coal from a mixture of coal and stones or quartz by zigging and determine the weight fractions of the products.
10. To separate a mixture of two minerals of different densities by gravity concentration using Wilfley Table and determine the weight and density of each fraction of the products.
12. To separate a mixture of iron and sand using magnetic separator and determine its efficiency.
13. Screening of ore/coal using vibrating screen and determine its effectiveness.
MINE PLANNING

Module - I:
Principle of Mine Planning, technical consideration in opening up & development of Mineral deposits, linear programming in mine planning.

Module - II:
Location of entries (Shaft, incline, Adit) & Lateral development, planning of mine workings & systems.

Module - III:

Book Recommended
1. Text Book of Mineral Economics by R. T. Desmukh
2. Mineral Economics
SMALL SCALE AND DIMENSIONAL STONE MINING

Objective:
Small-scale and artisan mining has been of considerable economic importance. Lately the mining of dimensioned stones has been increasing in tonnage, value and number of persons employed. This paper is meant for the students to get a clear perception in grasping the inner nature of small-scale and artisan mining intuitively an area of importance in the mining industry.

Module I
Definition and concept of artisan and small-scale mining. Special problems related to artisan and small scale mining. Overview of small scale mining in India: Locations, methods and machinery used. National Mineral Policy on small-scale mining: Concepts and application cluster mining, environmental impacts and mitigation measures. (12 hours)

Module II
Mining of placer deposits: Dry and aqueous extraction, panning, sluicing, hydraulicking, dredging etc, Application and treatment of these method in greater detail. Machinery used for placer mining. (12 hours)

Module III
Mining of dimensional stone deposits: conventional and modern methods. Cutting, sawing, processing and polishing techniques for dimensional stones. Machines used. Legislation related to dimensional stone mining. (12 hours)

Text Books:
1. Artisanal and small-scale mining: challenges and opportunities by Thomas Hentschel, Felix Hruschka, Michael Priester – IIED 2003
2. Small scale gold mining: processing techniques in developing countries by Michael Priester, Thomas Hentschel, German Appropriate Technology Exchange - Vieweg, 1992
3. The Profitable Small Mine, Prospecting to Operation by K.S.Stout - Hawthorne Blvd Books

References:
MINE AND MINERAL ECONOMICS

Objective:
The aim of this course is to give the students an overview of the economics of exploitation of mineral deposits including valuation of the deposits and mines, modes of financing, budgeting and impact of taxation policies.

Module I

Module II

Module III
Mineral taxation systems. Concept of cashflow. Investment analysis: pay back period, accounting rate of return, net present value, internal rate of return, benefit cost ratio. Mining finance: sources and norms of financing. Capital budgeting, balance sheet, profit and loss statements. Mine costing systems, preparation of cost sheets. (This module has to be taught with mining examples.) (12 hours)

Text Books:
5. Valuing Mining Companies by Charles Kernot – CRC Press 1999

References:
1. Economic Mining by Charles George Warnford Lock - Spon & Chamberlain, 1895
GIS & REMOTE SENSING

MODULE-I
Remote sensing- introduction, physics of remote sensing- electromagnetic radiations and their characteristics, thermal emissions, multi-concept in remote sensing, remote sensing satellites and their data products, sensors and orbital characteristics, spectral reflectance curves for earth surface features, methods of remotely sensed data interpretation- visual interpretation, concept of fcc, digital image processing- digital image and its characteristics, satellite data formats, image rectification and restoration, image enhancement- contrast manipulation, spatial feature manipulation, multi-image manipulation

MODULE-II
Fundamentals of GIS: introduction, definition of GIS, evolution of GIS, roots of GIS, definition, GIS architecture, models of GIS, framework for GIS, GIS categories, map as a model, spatial referencing system, map projections, commonly used map projections, grid systems, cartographic symbolization, types of maps, typography, map design, map productions, map applications, data management, models and quality issues: conceptual models, geographical data models, data primitives, data types - raster and vector approach, digital terrain modeling, approaches to digital terrain data modeling, acquisition of digital terrain data, data modeling and spatial analysis, sources of geographical data, data collectors and providers, creating digital data sets, data presentation, data updating, data storage.

MODULE-III
GIS data processing, analysis and visualization: raster based GIS data processing, vector based GIS data processing, human computer interaction and GIS, visualization of geographic information, principles of cartographic design in GIS, generation of information product, image classification and GIS, visual image interpretation, types of pictorial data products, image interpretation strategy, image interpretation process,

Reference Books:
2. Introduction Of GIS, Kang-Tsung Chang, Tata Mcgraw-Hill, New Delhi
3. GIS, N. Panigrahi, University Press, Hyderabad
module – I (12 hours)

introduction to state of satellite communication: Orbital mechanics and parameters, look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft system – Transponders, equipment reliability and space qualification.

satellite link design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

module – II (10 hours)

analog telephone and television transmission: Energy dispersal, digital transmission multiple access: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA. Spread Spectrum Transmission and Reception. Estimating Channel requirements, SPADE, Random access

application of satellite communication: Network distribution and direct broadcasting TV, fundamentals of mobile communication satellite

module – III (12 hours)

Propagation on satellite: Earth paths and influence on link design: Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects

Satellite Antennas: Types of antenna and relationships, Basic Antennas Theory – linear, rectangular & circular aperture. Gain, pointing loss,

Earth station Technology: Earth station design, Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,

Design of small earth station antennas: Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station

Text Books:

Reference Books:
1. Digital Communication with Satellite and Fiber Optic Application, Harlod Kolimbins, PHI
2. Satellite Communication by Robert M. Gagliardi, CBS Publishers
GEOSTATISTICS

Objective:
As the prior estimation of the ore reserves and their classification based on grades as well as
categories (proved, indicated, inferred etc.) is being given progressively greater importance in
making investment decisions, the course aims at giving the undergraduate students a brief
introduction to statistical methods of ores reserve estimation

Module I
aspects of sampling of bulk materials. Introduction to Geostatistical ore reserve estimation.
(12 hours)

Module II
Brief introduction to Kriging, Indicator kriging, Aggregation, Dissagregation, Turning bands,
Spectral simulation, Transition probabilities, Markov chain geostatistics, Markov mesh models,
Support vector machine, Boolean simulation, Genetic models, Pseudo-genetic models,
Cellular automata, Multiple-Point Geostatistics (MPS) (12 hours)

Module III
Definitions and tools: Regionalized variable theory, Covariance function, Semi-variance,
Variogram, Kriging, Range (geostatistics), Sill (geostatistics), Nugget effect. Over view of
Geostatistical software: gslib, sgems, mgstat, gstat (12 hours)

Text Books:
1. An Introduction to Applied Geostatistics by Isaaks, E. H. and Srivastava, R. M., Oxford
   University Press, New York, USA, 1989
   University Press, Cambridge 2009

References:
1. Armstrong, M and Champigny, N, 1988, A Study on Kriging Small Blocks, CIM Bulletin,
   Vol 82, No 923
   Company, Amsterdam
5. Hald, A, 1952, Statistical Theory with Engineering Applications, John Wiley & Sons,
   New York
6. Honarkhah, M and Caers, J, 2010, Stochastic Simulation of Patterns Using Distance-
   Based Pattern Modeling, Mathematical Geosciences, 42: 487 - 517 (best paper award
   IAMG 09)
7. ISO/DIS 11648-1 Statistical aspects of sampling from bulk materials-Part1: General
   principles
   New York.
10. Myers, Donald E.; "What Is Geostatistics?"
    http://www.ento.vt.edu/~sharov/PopEcol/popecol.html
INTERNET TECHNOLOGY & APPLICATIONS

Module – I (12 Hour)
The Internet and WWW
Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites

HTML
Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML using images links, Lists, Tables and Forms, Frames for designing a good interactive website

Module – II (12 Hour)
JAVA Script
Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try…. Catch Statement, Throw Statement, Objects of Javascript: Date object, array object, Boolean object, math object

CSS
External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag

DOM
HTML DOM, inner HTML, Dynamic HTML (DHTML), DHTML form, XML DOM

Module – III (12 Hour)
CGI/PERL
Introduction to CGI, Testing & Debugging Perl CGI Script, Using Scalar variables and operators in Perl

Java Applet
Introduction to Java, Writing Java Applets, Life cycle of applet

Textbooks
1. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar & others, Cengage Learning

Reference Books
3. Web Technologies, Uttam K Roy, Oxford