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<td>BSCM 1205</td>
<td>Mathematics – III</td>
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<td>Fluid Mechanics &amp; Hydraulic Machines</td>
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<td>PCME4202</td>
<td>Mechanics of Solids</td>
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<td>BECS2212</td>
<td>C++ &amp; Object Oriented Programming</td>
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**PRACTICALS / SESSIONALS**

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<td>Geology Lab.</td>
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**TOTAL SEMESTER CREDITS** 26

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<td>BEEE2215</td>
<td>Energy Conversion Technique</td>
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<td>PCML4202</td>
<td>Introduction to Mineral Processing and Metallurgy.</td>
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<td>PCMT4202</td>
<td>Metallurgy Thermodynamics and Kinetics</td>
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<td>Energy Conversion Technique Lab</td>
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<td>PCML7202</td>
<td>Mineral Processing lab</td>
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**TOTAL SEMESTER CREDITS** 26
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:

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.


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

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)
1. Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke’s law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads,
   Analysis of Axially Loaded Members : Composite bars in tension and compression - temperature stresses in composite rods, Statically indeterminate problems.
   Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson’s ratio, Bulk Modulus, Relationship between elastic constants.
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)
4. Shear Force and Bending Moment for Simple Beams :
   Shear force and bending moment. Types of load and Types of support. Support reactions, Relationship between bending moment and shear force, Point of inflection. Shear Force and Bending Moment diagrams.
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)
7. Theory of Columns:
   Eccentric loading of a short strut, Long columns, Euler’s column formula, Lateral buckling, Critical Load, Slenderness ratio
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
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
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:
Organizational Behaviour Process: Communication – Importance, Types, Gateways and Barriers to
Communication, Communication as a tool for improving Interpersonal Effectiveness, Groups in
Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-
making Managerial Implications, Effective Team Building. Leadership-Leadership & Management,
Theories of Leadership-Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and
Followership, How to be an effective Leader, Conflict-Nature of Conflict and Conflict Resolution. An
Introduction to Transactional Analysis (TA).

Module-III:
Organization: Organizational Culture – Meaning and Definition, Culture and Organizational
Effectiveness. Introduction to Human Resource Management-Selection, Orientation, Training and
Development, Performance Appraisal, Incentives Organizational Change – Importance of Change,
Planned Change and OB techniques. International Organisational Behaviour – Trends in International
Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global
Perspective.

Text Books:

Reference Books:
1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma” Organizational
   Behaviour”, TATA McGraw-Hill.
Module I  14 hours
Mineral resources: Brief idea about mineral resources of India: Geographical Distribution and reserves, Mining methods. Crystal systems- all normal classes.
Petrology- Brief description of Igneous, Sedimentary & Metamorphic rocks, Genesis of common rocks.
Crystallography – Axial relationship, symmetry elements and forms present in normal class of cubic, Tetragonal, Hexagonal, Orthorhombic, monoclinic and Triclinic systems.
Mineralogy – Classification of minerals, Physical properties of minerals, Chemical physical and optical properties of silicate mineral groups : Olivine, Garnet, pyroxene, Amphibole, Mica, Felspar and Quartz.

Module II  16 hours

Module III  6 hours
Mineral Deposits: Classification of mineral deposits, Process of formation of mineral deposits- Magmatic concentration, Hydrothermal, Residual and Mechanical concentration, contact metasomatism, Oxidation and supergene sulphide enrichment, sublimation, Evaporation and Metamorphism. Uses Mineralogy, mode of occurrence, genesis and Indian distribution of ore deposits viz., Iron, Manganese, chromium, Aluminium, Copper, Lead and Zinc, Radioactive minerals.
HSSM7203 Communication & Interpersonal skills for Corporate Readiness Lab.

Lab 30 hours

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
      
     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)

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PCML7201 **Geology Lab** (0-0-3)

1. Identification of crystals of the normal classes.
4th Semester

PCME4207 Machine Dynamics (3-1-0)

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.

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)
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.
BEEE2215 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
PCML4202 Introduction to Mineral Processing and Metallurgy

**Module-I**
(8 Hours)

Introduction to mineral processing, scope and importance, liberation and its importance-degree of liberation, Optimum degree of liberation

**Module-II**
(14 Hours)

Brief introduction to different types of unit operations; Quantification of mineral Engineering unit processes: recovery, ratio of concentration, enrichment ratio and separation efficiency etc. Economics of mineral processing.

**Module-III**
(14 Hours)

Basic concept of metallurgy, different types of metallurgical processes (pyro, hydro & electro metallurgy). Roasting, smelting, converting, leaching, precipitation processes. Faraday's laws, electro winning and refining.
Module I  (15 Hours)
Importance of Thermodynamics, definition of thermodynamic terms; concept of states, simple equilibrium. Equation of states, extensive and intensive properties, homogeneous and heterogeneous systems. Phase diagram of a single component system. Internal energy, heat capacity, enthalpy, isothermal, and adiabatic processes.

Second law of thermodynamics, entropy, degree of reversibility and irreversibility, criteria of equilibrium, auxiliary functions, combined statements, Maxwell’s relations, transformation formula, Gibbs-Helmoltz equation.

Concept of Third law of thermodynamics, temperature dependence of entropy, statistical interpretation of entropy, Debye and Einstein concept of heat capacity, relation between $C_p$ and $C_v$, consequences of third law.

Module II  (13 Hours)
Fugacity, activity, equilibrium constant, use of S-functions, controlled atmospheres, homogeneous and heterogeneous equilibria.
Ellingham – Richardson diagrams, phase stability diagrams.


Module III  (15 Hours)
Free energy – composition diagrams for binary alloy systems, determination of liquidus, solidus and solvus lines. Effect of pressure on phase transformation and phase equilibria.

Thermodynamics of electrochemical cells, solid electrolytes. Thermodynamics of point defects in solids.


References
1. Introduction to the Thermodynamics of Materials by D.R.Gaskell: Taylor and Francis.
BECS7208 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)

BEEC7215 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

PCML 7202 Mineral Processing Lab

1. Crushing of the ore and finding the R.R. of the Jaws.
3. Determination of critical speed of the ball mill.
4. Determination of grindability index of ball mill.
5. Laboratory screen analysis for finding average particle size. (Sieve analysis)
6. Roll crusher
7. Jigging.
8. Electromagnetic separation.

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