BIJU PATNAIK UNIVERSITY OF TECHNOLOGY

MECHANICAL ENGINEERING

3rd Semester

Theory	Contact Hrs.	Credit
	L-T-P	
BSCM1205 Mathematics - III	3-1-0	4
PCME4201 Fluid Mechanics & Hydraulic Machine	3-1-0	4
PCME4202 Mechanics of Solids	3-0-0	3
PCME4203 Introduction to Physical Metallurgy & Engg Materials	3-1-0	4
HSSM3204 Engineering Economics & Costing OR HSSM3205 Organizational Behaviour	3-0-0	3
BECS2208 Data Base Management Systems (DBMS)	3-0-0	3
Theory Credits		**21**

Practicals/Sessionals	Contact Hrs.	Credit
PCME7201 Machine Drawing	0-0-3	2
BECS7208 Data Base Management System Lab.	0-0-3	2
PCME7202 Mechanical Engg. Lab OR PCME7203 Machine Shop and Fabrication Practice	0-0-3	2
Practical/Sessional Credits		**6**
Total Credits		**27**

4th Semester

Theory	Contact Hrs.	Credit
	L-T-P	
BSCM1210 Mathematics - IV	3- 1-0	4
PCME4204 Kinematics & Dynamics of Machines	3- 1- 0	4
PCME4205 Engg.Thermodynamics	3- 0- 0	3
PCME4206 Basic Manufacturing Processes	3- 0- 0	3
HSSM3205 Organizational Behaviour OR HSSM3204 Engg. Economics & Costing	3- 0- 0	3
Free Elective-I (any one) BEEE2215 Energy Conversion Techniques/ PCCE4205 Surveying BECS2212 C++ & Object Oriented Programming/ BEEC2216 Analog and Digital Electronics	3-0-0	3
Theory Credits		**20**

Practicals/Sessionals	Contact Hrs.	Credit
PCME7204 Material Testing & Hydraulic Machines Lab	0- 0- 3	2
PCME7203 Machine Shop and Fabrication Practice OR PCME7202 Mechanical Engineering Lab	0- 0- 3	2
HSSM7203 Communication & Interpersonal Skills for Corporate Readiness	0- 0- 3	2
Practical/Sessional Credits		**6**
Total Credits		**26**

BSCM1205 **Mathematics - III**

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:
1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
    Reading Chapters: 11,12(except 12.10),13,14,15
2. B.V. Ramana, " Higher Engineering Mathematics", McGraw Hill Education, 2008
    Reading chapter: 18

Reference books:

1. E.B. Saff, A.D.Snider, " Fundamental of Complex Analysis", Third Edition, Pearson Education, New Delhi
    P. V. O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

PCME4201 Fluid Mechanics and Hydraulic Machines

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, orificemeter, 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
3.   Fluid Mechanics, A.K.Jain, Khanna Publishers

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
7.   Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, Pearson Education

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.

9.   Close - Coiled helical springs.

TEXT BOOKS

1.   Elements of Strength of Materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press
2.   Strength of Materials by G. H. Ryder, Macmillan Press
3.   Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning

REFERENCE BOOKS

1.   Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
2.   Mechanics of Materials by R.C.Hibbeler, Pearson Education
3.   Mechanics of Materials by William F.Riley, Leroy D.Sturges and Don H.Morris, Wiley
        Student Edition
4.   Mechanics of Materials by James M. Gere, Thomson Learning
5.   Engineering Machanics of Solids by Egor P. Popov, Prentice Hall of India
6.   Strength of Materials by S.S.Rattan, Tata Mc Graw Hill
7.   Strength of Materials by R.Subramaniam, Oxford University Press
8.   Strength of Materials by Sadhu Singh, Khanna Publishers

PCME4203 Introduction to Physical Metallurgy and Engineering Materials

MODULE-I   **(16 Lectures)**

Classification of Engineering Materials, Engineering properties of materials. Characteristic property of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond, crystal systems, common crystal structure of metals, representations of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfections crystals.

Concept of plastic deformation of metals, critical resolve shear stress, dislocation theory, deformation by slip and twin, plastic deformation in polycrystalline metals, yield point phenomenon and related effects, concept of cold working preferred orientation. Annealing ; recovery; recrystalization and grain growth; hot working.

MODULE-II   **(16 Lectures)**

        Concept of alloy formation, types of alloys, solid solutions, factors governing solids solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor; order-disorder transformation.

        Binary phase diagrams a) Isomorphism system, (b) Eutectic system, (c) Peritectic system, (d)Eutectoid system and (e) Peritectoid system. Allotropic transformation. Lever rule and its application, Interpretation of solidification behaviors and microstructure of different alloys belonging to those systems, Effect of non-equilibrium cooling, coring and homogenization.
Iron-cementite and iron-graphite phase diagrams, microstructure and properties of different alloys (alloy steels; stainless steel, tool steel, HSS, high strength low alloy steel) types of cast iron, their microstructures and typical uses. Specification of steel.

    T.T.T. diagram: concept of heat treatment of steels i.e. annealing, normalizing, hardening and tempering; microstructural effects brought about by these processes and their influences on mechanical properties; factor affecting hardenability.

MODULE-III   **(12 Lectures)**

<u>Optical properties of Materials</u>: Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres- Principle, structure, application of optical fibres.
<u>Plastic</u>-: Thermosetting and thermoplastics.
<u>Ceramics</u>: Types, structure, Mechanical properties, application
<u>Composite Materials</u>: Agglomerated Materials: Cermets .Reinforced Materials: Reinforced Concrete. Glass fiber reinforced plastics, Carbon fibre reinforced plastics, fibre reinforced plastics, Laminated plastic sheets. Tefnol, Properties of composites, Metal matrix composites, manufacturing procedure for fiber reinforced composite.
<u>Introduction to Nano</u>-materials

Text Books:
1. Engineering Physical Metallurgy and Heat Treatment by Y.Lakhtin, Mir Publisher, Moscow.
2. Introduction to Physical Metallurgy by Avner, Tata McGraw Hill
3. Materials Science and Engineering by W.D.Callister, Wiley and Sons Inc.

Reference Books
1. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
2. Physical Metallurgy: Principles and Practice by Ragahvan, PHI
3. The Science and Engineering of Materials by Donald R. Askeland and Pradeep P Phule, Thomson Learning (India Edition)
4. Materials Science and Engineering by V.Raghavan, Prentice Hall of India Pvt.Ltd.
5. Essentials of Material Science and Engineering by Donald R. Askeland and Pradeep P Phule, Thomson Learning
6. Processes and Material of manufacture by Lindberg, PHI.
7. Elements of Materials Science & Engineering by Van Vlack, Pearson
8. Mechanical Metallurgy by Dieter, Tata MacGraw Hill
9. Materials Science and Metallurgy By Daniel Yesudian, Scitech
10. Material Science and Metallurgy by C.K.Dutta, Dhanpat Rai
11. Materials Science and Metallurgy by R.B.Choudhary, Khanna Publishers
12. Principles of Engineering Metallurgy by L.Krishna Reddy, New Age International
13. Material Science and Processes by S.K.Hazra Chowdhury, Indian Book distributing Co.
14. Engineering Materials, Properties and Selection by Kenneth G. Budinski and Michael K. Budinski, Prentice Hall of India
15. Materials Science by M.S. Vijaya , G.Rangarajan, TMH
16. Materials Science by V. Rajendra, A. Marikani, , TMH

HSSM3204 **Engineering Economics & Costing**

Module-I: **(12 hours)**

Engineering Economics – Nature and scope, General concepts on micro & macro economics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply. Determination of equilibrium price under perfect competition (Simple numerical problems to be solved). Theory of production, Law of variable proportion, Law of returns to scale.

Module-II: **(12 hours)**

Time value of money – Simple and compound interest, Cash flow diagram, Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public

projects. Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method.

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:

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.
2. M.D. Mithani, Principles of Economics.

Reference Books :
1. Sasmita Mishra, "Engineering Economics & Costing ", PHI
2. Sullivan and Wicks, " Engineering Economy", Pearson
3. R.Paneer Seelvan, " Engineering Economics", PHI
4. Gupta, " Managerial Economics", TMH
5. Lal and Srivastav, " Cost Accounting", TMH

HSSM 3205 **Organizational Behaviour**

Module I :

The study of Organizational Behaviour : Defination and Meaning, Why Study OB
Learning – Nature of Learning, How Learning occurs, Learning and OB.
Foundations of Individual Behaviour : Personality – Meaning and Defination, 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, Confict-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 :

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswathappa, Organisational Behaviour, Himalaya Publishing House.
Reference Books :
1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
2. Pradip N. Khandelwal, Organizational Behaviour, McGraw-Hill, New Delhi.
3. Uma Sekaran, "Organizational Behaviour", TATA McGraw-Hill, New Delhi.
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma" Organizational
   Behaviour" , TATA McGraw- Hill.
5. D.K. Bhattachayya, "Organizational Behaviour", Oxford University Press
6. K.B.L.Srivastava & A.K.Samantaray, "Organizational Behaviour" India Tech

BECS2208 Database Management System

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)

Transaction processing: Recovery and Concurrency Control. Locking and Timestamp based Schedulers.
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
   (5) Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, "", 4th Edition, 2005, Elsevier India Publications, New Delhi

PCME7201 **Machine Drawing**

Orthographic and Sectional drawing of Machine components: (Any seven)
Screw threads, Screwed fastenings, Turn Buckle, Keys, Cotter joints and Knuckle joints; Pulley; Flanged coupling, Pedestal Bearing or Plummer Block.
Fundamentals of AutoCAD (Two classes)
1. Dimension & annotations
2. Use of Layers
3. Working with constraint in dimension
4. Creating assembly
5. Axi-symmetrical parts
6. Creating surface features
7. Working with bill of material

Drawing of the following using AUTOCAD: (Any two)
1. Projection of solids
2. Nut & bolt and Fasteners
3. Cotter joint
4. Expansion joint
5. Shaft coupling

Text Books:
1. Machine Drawing by N.D.Bhatt, V.M.Panchal, Charotar Publishing House.
2. Machine Drawing by N.D.Junarkar, Pearson Education
3. Machine Drawing with AutoCAD by Goutam Pohit and Goutam Ghosh, Pearson Education
4. Machine Drawing includes AutoCAD by Ajeet Singh, Tata MacGraw Hill

Reference Books:
1. Machine Drawing by K.L.Narayana, P.Kannaiah, K.Venkata Reddy, New Age International
2. Engineering Drawing and Graphics using AUTOCAD by T.Jayapoovan, Vikas Publishing
3. Engineering Drawing by N.D.Bhatt, Charotar
4. Engineering Drawing and Graphics + AutoCAD by K.Venugopal, New Age International

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)

PCME7202 Mechanical Engineering Lab

Group A

1.   Determination of equilibrium of coplanar forces.

2.   Determination of Moment of Inertia of Flywheel

3.   Determination of tensile strength of materials by Universal Testing Machine.

Group B

4.   Determination of Metacentric Height and application to stability of floating bodies.

5.   Verification of Bernoulli's Theorem and its application to Venturimeter.

6.   Determination of Cv and Cd of Orifices.

Group C

7.   Calibration of Bourdon Tube Pressure gauge and measurement of pressure using manometers.

8.   Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.

9.   Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.

PCME7203 Machine Shop and Fabrication Practice

1.   A job on lathe with taper turning, thread cutting, knurling and groove cutting
2.   Gear cutting (with index head) on milling m/c
3.   Working with shaper, planer and slotting m/c
4.   Working with surface/ cylindrical grinding
5.   TIG/ MIG welding, gas cutting

BSCM1210 **Mathematics – IV**

Module-I   **(20 hours)**

Numerical methods:
Approximation and round of errors, Truncation error and Taylor's series
Roots of equation: The bisection method, the false-position method, fixed point iteration, the Newton-Raphson method, Muller's method
Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method
Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton's forward and backward interpolation.
Numerical integration: The trapezoidal rule, The Simpson's rules, Gauss quadrature
Ordinary differential equation: Euler's method, Improvement of Euler's method, Runge-Kutta methods

Module-II   **(10 Hours)**

Probability:
Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several random variables.

Module-III   **(10 Hours)**

Mathematical Statistics:
Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Chi square test for goodness of fit , Regression Analysis, Fitting Straight Lines, Correlation analysis.

Text books:

1. S. C. Chapra and R. P. Canale, " *Numerical methods for Engineers*", Fifth Edition, McGraw Hill Education
   Reading Chapters : 2, 3(3.1, 3.2), 4(4.2, 4.3), 5(5.1, 5.2, 5.3), 6(6.4), 9(9.1, 9.2), 10(10.2), 13(13.1,13.2,13.5), 16(16.1, 16.2), 17(17.3), 20(20.1, 20.2, 20.3)

2. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
   Reading Chapters: 22, 23(except 23.5 and 23.8)

Reference books:

1. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd

      P. V.O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

PCME4204 Kinematics and Dynamics of Machines

Module - I   **(13Lectures)**

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, Gruebler's criterion, Inversion of mechanism, Four bar chains and their inversions, Single slider crank chain, Double slider crank chain and their inversion.
2.   Kinematic Analysis : Determination of velocity using graphical and analytical techniques, Instantaneous centre method, Relative velocity method, Kennedy theorem, Velocity in four bar mechanism, Slider crank mechanism, Rubbing velocity at a Pin-joint.
        Acceleration Diagram for a slider - crank mechanism, Corioli's component of acceleration and its application.

Module - III   **(14 Lectures)**

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.
    4.   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, mutiplate and cone clutches.

Module - III   **(13Lectures)**

6.   Brakes & Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle.
        Absorption and transmission dynamometers, Prony brake, Rope brake, Band brake dynamometer, Belt transmission dynamometer, Torsion dynamometer.
7.   Gear Trains : Simple Train, Compound train, Reverted train, Epicyclic train and their applications.
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

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference

1.   Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Education
2.   Theory of Machines and Mechanisms (India Edition) by John J. Uicker Jr., Gordon R. Pennock and Joseph E. Shigley, Oxford University Press
3.   Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers
4.   Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International
5.   Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, Prentice Hall of India
6.   Theory of Machines by R.S.Khurmi and J.K.Gupta, S.Chand Publication
7.   Theory of Machines by Shah Jadwani, Dhanpat Rai
8.   A Textbook of Theory of Machines by R. K. Bansal, Laxmi Publication
9.   Theory of Machines by Abdulla Shariff, Dhanpat Rai Publishers
10.   Theory of Machines by Sadhu Singh, Pearson Education

PCME4205 Engineering Thermodynamics

Module-I (13 Lectures)

1.   Review of First and Second laws:

   First law analysis of unsteady flow control volumes, Entropy generation, Reversible work, Availability, and Irreversibility.

2.   General Thermodynamic property relations:

   The Maxwell relations, The Clapeyron equation, The TdS relations, Isothermal compressibility and volume expansivity, The Joule-Thomson coefficient.

3.   Reciprocating Air Compressors:

   Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.

Module- II (10 Lectures)

4.   Vapor Power Cycles:

   The Carnot vapor cycle and its limitations, The Rankine cycle, Means of increasing the Rankine cycle efficiency, The reheat cycle, The regenerative feed heating cycle, The binary vapor cycle, The gas-vapor coupled cycles, Cogeneration (Back pressure and Pass-out turbines).

Module- III (12 Lectures)

4.   Gas Power Cycles:

   Air standard cycles- Otto, Diesel, Dual Combustion and Brayton cycles, The Brayton cycle with non-isentropic flow in compressors and turbines, The Brayton cycle with regeneration, reheating and intercooling, Ideal jet propulsion cycle.

5.   Refrigeration cycles:

   Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle.

Text Books

1.   Engineering Thermodynamics by P. K. Nag, Publisher:TMH
2.   Fundamentals of Thermodynamics by Sonntag, Borgnakke, Van Wylen, John Wiley & Sons
3.   Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI

Reference

1.   Engineering Thermodynamics by M.Achyuthan, PHI
2.   Engineering Thermodynamics by Y.V.C. Rao, University Press
3.   Steam Tables in SI Units by Ramalingam, Scitech
4.   Steam Tables by C.P.Kothandaraman, New Age International
5.   Thermodynamics and Thermal Engineering by Kothandaraman & Domkundwar, Dhanpat Rai
6.   Applied Thermodynamics by P.L.Ballaney, Khanna Publishers
7.   Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, Pearson Education.

PCME4206 Basic Manufacturing Process

Module - I   **(12 Lectures)**

1.   Foundry :

    (a) Types of patterns, pattern materials and pattern allowances.

    (b) Molding Materials - sand molding, metal molding, investment molding, shell molding.

    (c) Composition of molding sand, Silica sand, Zircon sand, binders, additives, Binders - clay, binders for CO_2 sand, binder for shell molding, binders for core sand.

    (d) Properties of molding sand and sand testing.

    (e) Melting furnaces - cupola, resistance furnace, induction and arc furnace.

    (f) Solidification of castings, design of risers and runners, feeding distance, centre line freezing resistance chills and chaplets.

    (g) Degasification and inoculation of metals.

    (h) Casting methods like continuous casting, centrifugal casting, disc casting.

    (i) Casting defects.

Module – II   **(12 Lectures)**

2.   Welding and cutting: Introduction to gas welding, cutting, Arc welding and equipment's. TIG (GTAW) and MIG (GMAW) welding, resistance welding and Thermit welding. Weldablity

      Modern Welding methods like plasma Arc, Laser Beam, Electron Beam, Ultrasonic, Explosive and friction Welding, edge preparation in butt welding.

      Brazing and soldering, welding defects.

      Destructive and non-destructive testing of castings and welding.

3.   Brief introduction to powder metallurgy processes.

Module – III   **(14 Lectures)**

4.   Plastic deformation of metals: Variables in metal forming and their optimization. Dependence of stress strain diagram on Strain rate and temperature. Hot and cold working of metals, classification of metal forming processes.

5.   Rolling: Pressure and Forces in rolling, types of rolling mills, Rolling defects.

6.   Forging: Smith Forging, Drop and Press forging, M/c forging, Forging defects.

7.   Extrusions: Direct, Indirect, Impact and Hydrostatic extrusion and their applications, Extrusion of tubes.

8.   Wire drawing methods and variables in wire-drawing, Optimum dies shape for extrusion and drawing.

9.   Brief introduction to sheet metal working: Bending, Forming and Deep drawing, shearing.

10.   Brief introduction to explosive forming, coating and deposition methods.

Text Books

1.   Manufacturing technology - by P.N.Rao, Tata McGraw Hill publication.

2.   Welding Technology by R.A. Little, TMH

3.   Manufacturing Science by A.Ghosh and A K Malick, EWP

Reference Books

1.   Fundamentals of metal casting technology by P.C. Mukherjee, Oxford PIBI.

2.   Mechanical Metallurgy by Dieter, Mc-Graw Hill

3.   Processes and Materials of Manufacture by R.A Lindberg, Prentice hall (India)

4.   A Text Book of Production Engineering by P.C.Sharma, S.Chand

BEEE2215 **Energy Conversion Techniques**

MODULE- I (10 Hrs)

1. <u>DC GENERATORS</u>: 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. <u>DC MOTORS</u>: 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. <u>SINGLE PHASE TRANSFORMERS</u>: 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. <u>INDUCTION MOTORS</u>: (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. <u>THREE PHASE SYNCHRONOUS GENERATORS</u>: Constructional Features, Principle of operation as Alternator, Synchronous reactance, Equivalent circuit of alternator, Power-Angle curve, Synchronization of alternators.

6. <u>THREE PHASE SYNCHRONOUS MOTORS</u>: Constructional Features, Principle of Operation, Torque Expression and Phasor Diagram for Synchronous Motor, Electrical Power and Mechanical Power, Starting and application of Synchronous Motor.

Text Book :

1. Electric Machines – D P Kothari & I J Nagrath – Tata McGraw Hill.

Reference Book(s):

2. The Performance and Design of DC Machines – A E Clayton.

3. Theory and Performance of AC Machines – M G Say

4. Electrical Machinery – P S Bimbhra – Khanna Publishers.

5. Electrical Machines – P K Mukherjee and S Chakravorti – Dhanpat Rai Publications.

6. Electric Machinery – Fitzgerald, Charles Kingsley Jr., S. D. Umans – Tata Mc Graw Hill.

7. Electric Machinery And Transformers – Guru & Hiziroglu – Oxford University Press.

8. Electric Machines – Charles Hubert – Pearson Education.

PCCE4205 **Surveying**

Module I

Linear measurement and chain survey: Use of various types of chains and tapes, measurement of correct length of lines, direct and indirect ranging, chaining along sloping ground. Obstacle in chaining, errors and their elimination.

Compass surveying: Use of prismatic compass, temporary adjustment, bearing of a line, local attractions, correction of bearing

Plane table surveying: Methods of plane tabling, radiations, intersection, traversing and resection, two point and three point problem. Adjustment and common error in plane table survey.

Module II

Levelling: Use of dumpy level and levelling staff. Temporary and Permanent adjustment of dumpy level, Reduction of levels by height of instrument and rise and fall method. Curvature and refraction error, sensitiveness of level tube, reciprocal levelling, levelling difficulties and common errors

Module III

Contouring: Contour interval and horizontal equivalent, characteristics of contours, methods of contouring- different and indirect method, contour gradient

Theodolite Survey: Use of theodolite, temporary adjustment, measuring horizontal and vertical angles, theodolite traversing

TEXT BOOKS:

1. Surveying and Levelling Vol-1, T. P. Kanetkar and S. V. Kulkarni
2. Surveying- Vol-1, B.C. Punmia
3. Surveying Vol01 by R Agor

BECS2212 **C++ and 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)
3. "C++ and Object Oriented Programming" – Jana, PHI Learning.
4. "Object Oriented Programming with C++ "- Rajiv Sahay, Oxford
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

"Object Oriented Programming with C++", David Parsons, Cengage Learning.

BEEC2216 Analog and Digital Electronics

MODULE – I   **(9 Hours)**

1. **Diode Circuits:** Zener Diode Voltage Regulator, Diode Circuits with Time-Varying Sources, Switching Characteristics of a Diode, Special Purpose Diodes , Rectifiers and Filters.   (4 Hours)

2. **Small Signal Amplifier:** Transistor Hybrid Model, Transistor Biasing, Bias Design, AC Gain, Input and Output Impedances, Some Special Circuits, Darlington Pairs and Feedback Pairs, Frequency Response of Single Stage RC Coupled Amplifiers and Multistage Transistor Amplifiers.   (5 Hours)

MODULE – II (12 Hours)

3. **Large Signal Amplifiers:** Classification, Class-A and Class-B Power Amplifiers Complimentary and Symmetry Amplifiers, Class-C Amplifiers. .   (4 Hours)
4. **Feed Back Amplifiers and Oscillators:** Feedback Concepts, Types of Feedback Circuits, Effects of Negative Feedback Circuits, Unijunction Oscillator and PLL.   (4 Hours)
5. **Operational Amplifier:** Basic Operational Amplifier, Differential Amplifier, Basic Operational Amplifier Circuits, Application of OPAMPs, Linear Application of OPAMPs, OPAMP Filters.
                                                                                        (4 Hours)

MODULE – III (13 Hours)

6. **Conditional Circuits:** Introduction to Digital Electronics Circuits, K-maps and their Simplification, Adder, Subtractors, Digital Comparator Circuits, Parity Checkers/Generators, Multiplexers and Decoders, Demultiplexers/Decoders, Programmable Logic Arrays.   (5 Hours)
7. **Sequential Circuits and Systems:** Introduction, Memory Cells and Flip-Flops, Resistors, Counters, Asynchronous Counters, State Diagrams, Memories, ROM and RAM, Digital to Analog and Analog to Digital Converters (DAC and ADC).   (5 Hours)
8. **Multivibrators and Switching Regulators:** Multivibrators, Analog Multivibrators, 555 Timer, Power Supply and Regulators   (3 Hours)

Text Books:

1. Electronics: Analog and Digital, I.J. Nagrath (Selected portions of Chapter 1, 3, 4, 5, 6, 7, 9, 10, 11), PHI Learning Pvt. Ltd., New Delhi.

Reference Books:

1. Millman's Electronic Devices and Circuits, 2nd Edition, J. Millman, C. Halkias, and S. Jit, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. Electronic Devices and Circuit Theory, 9th/10th Edition, R.L. Boylestad and L. Nashelsky, Pearson Education, New Delhi.
3. Digital Fundamentals, 5th Edition, T.L. Floyd and R.P. Jain, Pearson Education, New Delhi.
4. Fundamentals of Digital Circuits, 2nd Edition, A. Anand Kumar, PHI Learning Pvt. Ltd., New Delhi.

PCME7204 Material Testing and Hydraulic Machines Lab

Material Testing :

1. Impact strength
2. Hardness strength
3. Rigidity modulus
4. Compression / Bending strength
5. Fatigue strength

Hydraulic Machines :

1. Experiments on impact of Jets
2. Experiments on performance of reciprocating pump
3. Experiments on performance of centrifugal pump
4. Experiments on performance of Pelton Turbine
5. Experiments on performance of Francis Turbine
6. Experiments on performance of Kaplan Turbine

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.
   ii. Motivating subordinates / juniors ('pep talk')
   iii. Instructing/ directing subordinates/ juniors
   iv. 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

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