

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

MANUFACTURING ENGINEERING & TECHNOLOGY

<u>3rd SEMESTER</u>				<u>4th SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact Hours</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
BSCM1205	Mathematics – III	3-1-0	4	BSCM1210	Mathematics – IV	3-1-0	4
HSSM3204	Engineering Economics & Costing	3-0-0	3	HSSM3205	Organizational Behavior	3-0-0	3
PCMF4201	Manufacturing Technology – I	3-0-0	3	PCMF4204	Manufacturing Technology – II	3-0-0	3
PCMF4202	Metrology	3-0-0	3	PEPL5307	Strength of Materials	3-1-0	4
PCME4203	Introduction to Physical Metallurgy & Engineering Materials	3-1-0	4	BECS2212	C++ & Object Oriented Programming	3-0-0	3
PCMF4203	Theory of Machines	3-0-0	3	PCMF4205	Work Study & Ergonomics	3-0-0	3
Credits (Theory)			20	Credits (Theory)			20
<i>PRACTICALS/SESSIONALS</i>				<i>PRACTICALS/SESSIONALS</i>			
PCMF7201	Metrology Lab.	0-0-3	2	PCMF7204	Manufacture Technology Lab – II.	0-0-3	2
PCMF7202	Manufacture Technology Lab – I.	0-0-3	2	BECS7207	C++ and Object Oriented Programming lab	0-0-3	2
PCMF7203	Computer Aided Drawing Lab.	0-0-3	2	PCMF7205	Material Testing Lab.	0-0-3	2
Credits (Practicals / Sessionals)			6	Credits (Practicals/Sessionals)			6
TOTAL SEMESTER CREDITS			26	TOTAL SEMESTER CREDITS			26
TOTAL CUMULATIVE CREDITS				TOTAL CUMULATIVE CREDITS			

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

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. D.M. Mithani, Principles of Economics. Himalaya Publishing House

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

MANUFACTURING TECHNOLOGY-I

Module I

(12

hours)

Manufacturing concepts; Primary and secondary manufacturing processes; Principle of metal casting; Terminology; Pattern; Types; Allowances; Materials; Core boxes; Selection; Testing and preparation of moulding sands; Moulding tools and equipment; Machine moulding; Core making; Sprue; Runner, gates and risers; Types and designing; Melting and pouring the metal; Shell mold casting; Investment casting; Permanent mould casting; Casting defects.

Module II

(12

hours)

Formability of metals; Cold and hot working; Rolling; Types; Roll size; Stretch forming, metal spinning, embossing and coining; Peening; Sheet metal forming operations; Presses; Die design. Forging materials; Forging processes; Forging techniques; Forging presses; Forging pressure distribution and forging force; Automation of forging; Swaging; Drawing; Extrusion; High energy rate forming.

Module III

(11

hours)

Weldability; Welding metallurgy; Principles and processes of arc welding (SMAW, GTAW, GMAW, FCAW, PAW, SAW); Welding equipment; Weld positioners and fixtures; Oxyacetylene welding; Flame cutting; Brazing and soldering; Principle of resistance welding; Types of resistance welds; Seam welding; Projection welding; Resistance butt welding; Solid state welding; Weld inspection and testing.

Text Book:

1. Process and Materials of Manufacture (4th Edition) by Roy A. Lindberg, Prentice-Hall of India Private Limited.

Reference Books:

1. Manufacturing Engineering & Technology by Kalpak Jain, Addison Wesley Edition.
2. Materials and Processes in Manufacturing by De Margo, Black and Kohsen, Prentice Hall of India.
3. Principles of Metal Casting by Hein and Rosenthol, Tata Mc-Graw Hill India.
4. Manufacturing Technology-Foundary, Forming and Welding by P.N. Rao, Tata McGraw-Hill Publishing Company.

METROLOGY

Module-I

(11 Hours)

Metrology: Need of Inspection, Precision and accuracy, Accuracy and cost, Sources of error, Types of error, and Geometry of form on shape. Line standard, end standard, limits, fits, tolerances-Hole & shaft basis system, Interchangeability, selective assembly, ISO system for limits & fits, Limit gauges-Snap, plug, ring, taper, position gauges-Gauge design, Taylor's principle. Wear allowance, Screw allowance Screw thread gauge, Thread pitch gauge.

Module-II

(11 Hours)

Comparators- Characteristics, Relative Advantages of various types of comparators- Mechanical, optical, Pneumatic, Fluid displacement type, Measurement by light wave Interference optical flat.

Measurement of straightness- Autocollimator flatness testing measurement of circularity-types of irregularities. Angular measurement-measurement of angle of tapered hole.

Module-III

(13 Hours)

Surface Measurements- Roughness and waviness, Surface texture, cut off length, RMS & CLA values, Surface roughness measuring instruments, Principle of working.

Metrology of screw thread- Errors in threads, measurement of element of threads, 2-wire & 3-wire methods, Measurement & testing of gears-Measurement of error, rolling test, gear tooth calliper, base tangent comparator.

Non destructive testing

TEXT BOOK(S):

1. Engineering Metrology- R.K. Jain
2. Production Technology- P.C. Sharma

REFERENCE(S):

1. Engineering Dimensional Metrology- Miller, Edward Arnold pub.
2. Precision Engineering in Metrology- R.L. Murty, New Age Int.

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)

Optical properties of Materials: Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres- Principle, structure, application of optical fibres.

Plastic:- Thermosetting and thermoplastics.

Ceramics: Types, structure, Mechanical properties, application

Composite Materials: Agglomerated Materials: Cermets .Reinforced Materials: Reinforced Concrete. Glass fiber reinforced plastics, Carbon fibre reinforced plastics, fibre reinforced plastics, Laminated plastic sheets. Teflon, Properties of composites, Metal matrix composites, manufacturing procedure for fiber reinforced composite.

Introduction to Nano-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

THEORY OF MACHINE

Module-I

(10 Hours)

Mechanism: Basic Kinematic concepts and definitions, mechanism, link, kinematic pair, classification of kinematic pairs, degree 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

(13 Hours)

Friction of a screw and nut, square threaded screw, V-threaded screw, pivot and collar, friction circle, friction axis, friction clutches, transmission of power by single plate, multiplate and cone clutches.

Gear trains: simple train, compound train, reverted train, epicyclic train and their application. Toothed gears: Theory of shape and action of tooth properties methods of generation of standard Tooth profiles, Standard proportions, Interference and Under-cutting,

Module-III

(12 Hours)

Cams: Simple harmonic, constant velocity and constant acceleration types. Displacement, velocity and acceleration of follower. Cams with specified Contours.

Governors: Centrifugal Governors-watt and Porter Governors, Spring loaded Governor-Hartnell Governor ,sensitiveness, stability, Isochronism ,Hunting,

Balancing: Balancing of revolving masses in one plane and different planes, Partial balance of single cylinder engine.

TEXT BOOK

1. Theory of machines – SS Ratan, Tata McGraw Hill.
2. A Textbook of theory of machines (in S.I units) – R.K.Bansal, Laxmi Publication.

REFERENCES

1. Mechanism and machine Theory- Rao and Dukkupati, Wiley Eastern Ltd.
2. Theory of Machines –Thomas Beven.

PRACTICALS/SESSIONALS

METROLOGY LAB

LIST OF EXPERIMENTS

1. Calibration of Dial gauge, Micrometer, Vernier and Height gauge
2. Use of Sine bar for measuring angles
3. Study and use of Profile Projector
4. Measurement of thread parameters using Floating Carriage Micrometer
5. Surface roughness measurement
6. Use of Mechanical and Pneumatic comparator
7. Measurement of gear tooth thickness
8. Measurement of Internal, External angles and Bores using standard Balls, and Height gauge.
9. Measurement of Straightness and Flatness using precision level.
10. Study and use of Toolmaker's microscope
11. Study of Digital measuring instruments

MANUFACTURING TECHNOLOGY LAB- I

LIST OF EXPERIMENTS

Measurement of the Machined Components and Machining time estimation of:

1. Taper Turning
2. External thread cutting
3. Internal thread cutting
4. Eccentric Turning
5. Knurling
6. Square Head Shaping
7. Hexagonal Head Shaping
8. Drilling and Tapping
9. Determination of Cutting forces in Turning and Milling Operations.

REFERENCES

1. Hajra Choudhury, S.K and Hajra Choudhury. A.K., " Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
2. Sharma, P.C.A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
3. Roy. A. Lindberg, "Process and Materials of Manufacture", Pearson Education Fourth Edition 2006

COMPUTER AIDED DESIGN LAB

1. Basic concepts of CAD/CAM.
2. Introduction to Fundamentals of AutoCAD with operating system commands/menus, familiarization with computerized drafting software use at help and tutorial menus.
3. Introduction to CAD tools and commands. To draw 2D basic shapes. Lines, curves, areas, circles etc.
4. Modify tools: copy, more, offset, array etc. Working with Blocks.
5. Dimensioning, Use of layers, & Drawing template. To draw simple 2D drawing.
6. Printing, export, import of CAD files in different format like jpg, dxf any dwg dwt., iges, stl. etc.
7. Introduction solid modeling of 3D components using sketching and feature like extrude, revolve, sweep, fillet etc.
8. Over view of projection of solid standard views, sectional views, and detail views.
9. Creating assembly drawing.
10. Development of drawing surface features.
11. Projection of different solid models.
12. Thread profiles Nomenclature types – Metric, BSP, BCW, ACME, Buttress, and Knuckle thread.
13. Nut & bolt and fasteners.
14. Machining assemblies: Gib and cotter joint, shaft coupling.
15. Making one screw jack assembly and its 2D drawing and parts lists generation with bill of materials.

Text Books:

1. Machine Drawing by N.D.Bhatt, V.M.Panchal, Charotar Publishing House.
2. Machine Drawing with AutoCAD by Goutam Pohit and Goutam Ghosh, Pearson Education
3. Machine Drawing includes AutoCAD by Ajeet Singh, Tata MacGraw Hill
4. Machine Drawing (Includes AutoCAD) by Ajeet Singh, Tata McGraw Hill
5. Engineering Drawing with an Introduction to AutoCAD by Dhanjay A. Johle, Tata McGraw Hill

Reference Books:

1. Engineering Drawing and Graphics using AUTOCAD by T.Jayapoovan, Vikas Publishing
2. Engineering Drawing by N.D.Bhatt, Charotar
3. Engineering Drawing and Graphics + AutoCAD by K. Venugopal, New Age International
4. Design Data Book, PSG Technology, Coimbatore

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

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

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 Follower
ship, 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 :

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswhathappa, 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
7. Kavita Singh, "Organizational Behaviour", Pearson

MANUFACTURING TECHNOLOGY-II

Module-I

(16 Hours)

Basic shapes of machine tools. Wedge action, function of different angles of cutting tools, tool geometry, and Nomenclatures ASA, ORS systems. Conversion of angles, geometry of twist drill & slab milling cutter, grinding of single point cutting tool. Tool materials.

Force system in turning- Merchant circle diagram, velocity relationship .Stress in conventional shear plane, Energy of cutting process, Ernst & Merchant angle relationship, Forces in drilling and plane slab milling. Measurement of forces- dynamometer for measuring turning & drilling forces.

Module-II

(10 Hours)

Mechanism of chip formation: Mode of failure under stress- fracture & yielding mechanism.

Thermodynamics of chip formation: The shear plane temperature-interface temperature from dimensional analysis-Experimental determination of chip tool interface temperature. Coolants-mechanism cooling action

Module-IV

(8 Hours)

Tool wear: Criteria of wear. Machinability and tool life, Flank wear. Taylor's tool life equation, Crater wear, Causes and mechanism of tool failure. Vibration & chatter in machining. Economics of metal machining.

TEXT BOOK(S):

1. Metal cutting Theory & Practice- A.Bhattacharya, C.B.Pub.
2. Production Technology- P.C Sharma.

REFERENCE(S):

1. Fundamentals of Metals machining & machine Tools- Boothroyd- International student Edition.
2. Theory of Metal cutting- Milton Shaw

STRENGTH OF MATERIALS

Module I

(15 hours)

Elasticity: Stress and strain, compressive, tensile, shear and bearing stress - Stress - strain diagram, Hooks law, modulus of elasticity, modulus of rigidity, bulk modulus of rigidity, bulk modulus, Poisson's ration. Relationship between elastic constraints and temperature stresses, composite bars, dead, live and shock loads.

Properties of section, calculation of areas, centroid, neutral axis, moment of inertia, modulus of section, radius of gyration with reference to structural shapes.

Module II

(15 hours)

Theory of simple bends - relationship between load shearing force and bending moment. Bending moment and shear force diagram for cantilever, simple supported and over hanging beams - bending stresses.

Deflection - deflection of beams in simple cases. Principal stresses and stains.

Torsion in solid and hollow shafts - combined bending and torsion.

Module III

(15 hours)

Thin and thick cylinders and shells subjected to internal and external pressures.

Column and struts - long and short columns - axial and eccentric loading - effect of end conditions – equivalent length and slenderness ratio - Euler and Rankine formulae.

References Books:

1. R.S. Khurmi, Applied Mechanics and Strength of Materials S.Chand & Co., (6th ed), New Delhi, 1987.
2. P.N. Singh and I.K.Jha, Elementary Mechanics and Solids, Wiley Eastern, New Delhi.
3. Timoshenko, Strength of Materials
4. Singer, Strength of Materials

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)
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)

WORK STUDY & ERGONOMICS

Module I (10 hours)

Introductory Concepts

Definition, objective and scope of work study and ergonomics and its historical background, Interrelationship between work study & ergonomics, role of work study & ergonomics in productivity improvement

Method Engineering

Definition, objectives and procedure of method analysis, Principles of motion economy and methodology of motion analysis.

Module II (10 hours)

Work Measurement

Definition, objective and different methods of work measurement – stop watch time study, predetermined motion time system (PMTS)

Work Sampling

Principle, techniques and applications of work sampling studies

Module III (13 hours)

Job Evaluation and Merit Rating

Definition, objectives and techniques of job evaluation and merit rating

Wages & Salary

Definition and principles of wage and salary administration, comparative study of incentive schemes

Ergonomics

Man – machine interaction, design of man-machine environment system, workstation design

TEXT BOOKS

1. Motion & Time Study Barnes Ralph. M., John Wiley & sons, 7th edition.
2. Work Study O. P. Khanna, Dhanpat Rai & sons, New Delhi
3. Motion and time study – principles and practice M.E.MUNDELpRENTICE Hall india pvt. Ltd.
4. Introduction to work Study – ILO
5. Human Factors in Engineering Design – E.J.McCormick, Tata McGrawHill
6. Hand book of Ergonomic Design – Martin Helender

PRACTICALS/SESSIONALS

MANUFACTURE TECHNOLOGY LAB – II.

LIST OF EXPERIMENTS

1. Measurement of cutting force in drilling.
2. Measurement of cutting force in milling.
3. Measurement of cutting force in turning.
4. Temperature measurement in turning.
5. Vibration study of machine tools.
6. Verification of Taylor's tool life equation.
7. Study of different types of chips.
8. Determination of shear angles.
9. Ring Compression test.
10. Determination of coefficient of friction by using compression tests.
11. Formability test-Ericsson cupping test.

BECS7207 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)

MATERIAL TESTING LAB

LIST OF EXPERIMENTS

1. Preparation of testing specimen
2. Tensile strength
3. Impact strength
4. Hardness strength
5. Rigidity modulus
6. Compression / Bending strength
7. Fatigue strength
8. Wear resistance test
9. Thermal characterization of materials using DSC and TGA
