# BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

## MANUFACTURING ENGINEERING & TECHNOLOGY

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>L-T-P</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BSCM1205</td>
<td>Mathematics – III</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td>HSSM3204</td>
<td>Engineering Economics &amp; Costing</td>
<td>3-0-0</td>
<td>3</td>
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<tr>
<td>PCMF4201</td>
<td>Manufacturing Technology – I</td>
<td>3-0-0</td>
<td>3</td>
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<tr>
<td>PCMF4202</td>
<td>Metrology</td>
<td>3-0-0</td>
<td>3</td>
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<tr>
<td>PCMF4203</td>
<td>Introduction to Physical Metallurgy &amp; Engineering Matériaux</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td>PCMF4203</td>
<td>Theory of Machines</td>
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<td>3</td>
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<tr>
<td>BECS2212</td>
<td>C++ &amp; Object Oriented Programming</td>
<td>3-0-0</td>
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| Credits (Theory) | 20 |

## PRACTICALS/SESSIONALS

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<th>Subject</th>
<th>L-T-P</th>
<th>Credits</th>
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<td>Metrology Lab.</td>
<td>0-0-3</td>
<td>2</td>
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<tr>
<td>PCMF7202</td>
<td>Manufacturing Technology Lab – I.</td>
<td>0-0-3</td>
<td>2</td>
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<tr>
<td>PCMF7203</td>
<td>Computer Aided Drawing Lab.</td>
<td>0-0-3</td>
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| Credits (Practicals / Sessionals) | 6 |

## TOTAL SEMESTER CREDITS

26

## TOTAL CUMULATIVE 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:
   Reading Chapters: 11,12(except 12.10),13,14,15

Reference books:
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:
   India.

Reference Books :
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:

Reference Books:
3. Principles of Metal Casting by Hein and Rosenthol, Tata Mc-Graw Hill India.
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):
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.
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; recrystallization 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)

Plastic: Thermosetting and thermoplastics.

Ceramics: Types, structure, Mechanical properties, application

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

**Reference Books :**
1. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
2. Physical Metallurgy: Principles and Practice by Ragahvan, PHI
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
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 crew, V-threaded screw, pivot and collar, friction circle, friction axis, friction clutches, transmission of power by single plate, multiplate and cone clutches.


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

REFERENCES
2. Theory of Machines –Thomas Beven.
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.
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

REFERENCES
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.
10. Development of drawing surface features.
11. Projection of different solid models.
15. Making one screw jack assembly and its 2D drawing and parts lists generation with bill of materials.

Text Books:
5. Engineering Drawing with an Introduction to AutoCAD by Dhanjay A. Johle, Tata McGraw Hill

Reference Books:
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
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:
   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)
   Reading Chapters: 22, 23(except 23.5 and 23.8)

Reference books:
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,

Module-III

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.
MANUFACTURING TECHNOLOGY-II

Module-I  
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.

Module-II  
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  

TEXT BOOK(S):
2. Production Technology- P.C Sharma.

REFERENCE(S):
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, Hook's law, modulus of elasticity, modulus of rigidity, bulk modulus of rigidity, bulk modulus, Poisson's ratio. 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:
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)
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
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
MANUFACTURE TECHNOLOGY LAB – II.

LIST OF EXPERIMENTS

1. Measurement of cutting force in drilling.
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.
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

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# BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

## MANUFACTURING ENGINEERING & TECHNOLOGY

### 5TH & 6TH SEMESTERS

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<td>HSSM3302</td>
<td>Optimization Engineering</td>
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<tr>
<td>BEME2209</td>
<td>Fluid Mechanics &amp; Machines</td>
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<tr>
<td>HSSM3303</td>
<td>Environmental Engineering &amp; Safety</td>
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<tr>
<td>PCME4303</td>
<td>Design of Machine Elements</td>
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<tr>
<td>PEMF5301</td>
<td>Professional Elective – I (Any One)</td>
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<td>PEMF5302</td>
<td>Plastics Processing</td>
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<td>PEMF5303</td>
<td>Advanced Casting and Welding</td>
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**Credits (Theory)**: 19 | **Credits (Theory)**: 19

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<td>Fluid Mechanics Lab.</td>
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<tr>
<td>PCMF7302</td>
<td>Machine Design Sessional</td>
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<td>PCMF7303</td>
<td>Manufacturing Technology Lab. III</td>
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**Credits (Practicals / Sessionals)**: 6 | **Credits (Practicals / Sessionals)**: 6

**TOTAL SEMESTER CREDITS**: 25 | **TOTAL SEMESTER CREDITS**: 25

**TOTAL CUMULATIVE CREDITS**: 133 | **TOTAL CUMULATIVE CREDITS**: 158
Module-I (10 Hours)
Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.
Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

Module-II (10 Hours)
Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel’s approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method
Assignment problems: Hungarian method for solution of Assignment problems
Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems
Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module-III (10 Hours)
Non-linear programming: Introduction to non-linear programming.
Unconstraint optimization: Fibonacci and Golden Section Search method.
Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method
Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming
Introduction to Genetic Algorithm.

Recommended text books

Recommended Reference books:
Module I (12 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 static 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 flotation, Archimedes’ principle, stability of immersed and floating bodies, determination of metacentric height.

Module II (10 Lectures)
Fluid dynamics : Introduction, Euler’s equation along a streamline, energy equation, Bernoulli’s equation,
Hydraulic Measurements: Water level measurements, velocity measurements, discharge measurements, venturimeter, orifice meter, current meter, pitot tube, orifice, notch and weir.

Module III (13 Lectures)

Text Books
1. Fluid Mechanics and hydraulic machines, Modi & Seth
2. Hydraulics fluid machines and fluid machines by S. Ramamrutham

Reference Books:
1. Fluid Mechanics by A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics by Fox and 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
**HSSM3303 ENVIRONMENTAL ENGINEERING & SAFETY (3-0-0)**

**Module – I**

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

**Module – III**

**Text Book :**
2. Environmental Engineering by Prof B.K. Mohapatra, Dhanpat Rai & Co Publication

**Reference Books**
1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
PCME4303 DESIGN OF MACHINE ELEMENTS (3-1-0)

**Module-I**
(12 hours)
Design of Joints: Riveted joints, Boiler joints, Welded and bolted joints based on different types of loading. Illustrative problems with solutions.

**Module-II**
(14 hours)
Design of Cotter joints with socket and spigot, with a Gib. Design of knuckle joint. Illustrative problems with solutions.
Design of shafts, solid and hollow based on strength and on rigidity. Illustrative problems with solutions.
Design of keys and pins, Suck key, Feather key, Taper pin. Illustrative problems with solutions.
Design of shaft couplings: Rigid Flange coupling, Flexible Flange coupling.

**Module-III**
(14 hours)
Design of circular section, Helical springs, Tension and compression types, Design of leaf springs: Cantilever and semi-elliptical types. Illustrative problems with solutions.
Levers, classification, Design of Foot levers, Hand lever, Cranked lever, Lever of lever loaded – safety - valve. Design of belt and pulley Power screw design with square thread, such as screw jack. Illustrative problems with solutions.

[Only specified data book as mentioned in the syllabus is permitted during examination]

**TEXT BOOKS:**

**REFERENCE BOOKS:**

**DESIGN DATA HAND BOOKS:**
1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbatore
3. Design Hand Book by S.M. Jalaluddin ; Anuradha Agencies Publications
PROFESSIONAL ELECTIVES -1

PEMF5301 PLASTIC PROCESSING (3-0-0)

Module—I (12 hours)
INJECTION MOULDING, COMPRESSION MOULDING & TRANSFER MOULDING

Module – II (13 hours)
EXTRUSION, BLOW MOULDING, THERMOFORMING
Basic principles of extrusion – Types of extruders, extruder parts- polymer flow mechanism, die entry effects and exit instabilities-melt fracture & Bambooing. Factors affecting the output of an extruder, process variables in extrusion- downstream equipments for the production of films, blown film, cast film/slot film, BO film, co extruded film. Tube/pipe-sizing take off equipment, extrusion coating, wire & cable covering
Injection and extrusion blow moulding processes, accumulation blow moulding-processing parameters- materials requirements -blow moulding machine features and operation -faults, causes and remedies-parison programming, blow moulding of difficult articles like fuel tanks, odd shaped containers with handles, limitation in blow moulding,
Basic principles and types of thermoforming processes, Thermoforming moulds-processing parameters—faults, causes and remedies.

Module – III (10 hours)
CALENDARING, ROTATIONAL MOLDING AND FRP & LAMINATES
Calendaring - principle and process description- types of calendar units -design of calendar roll, Heating and temp control, roll crown, roll crossing and roll bending - calendaring sheets and films, embossing, coating and lamination by calendar, comparison between calendaring and extrusion.

Text Book
1. Injection Molding Theory & Practice, Irvin I. Rubin, Wiley-Interscience (1973)

Reference Book:
3. Extrusion The definitive Processing Guide and Hand Book - By Giles, H.H & Others
4. Compression Molding - By Iyesew, A.I
5. Polymer Extrusion - By Rauwedaal, Chris
7. Basic Principle of Thermoforming - By Brycle, D.M
8. Calenndering of Plastics - By Elden & Swan
PEMF5302 ADVANCED CASTING & WELDING (3-0-0)

MODULE I (12 hours)
CASTING DESIGN: Solidification of pure metals and alloys-shrinkage in cast metals-design of sprue, runner, gate and risers-problems in design and manufacture of thin and unequal sections designing for directional solidification, minimum distortion and for overall economy - design problems of L, T, V, X and Y junctions.

Module II (10 hours)
WELD DESIGN AND WELDING METALLURGY: Design of welded components-symbolic representation of welds on drawings- welding classes-residual stresses in welds-weld distortions-design consideration-strength consideration of welded joints-analysis of statistically loaded welded joints-welded structures subjected to fatigue loads.

MODULE III (12 hours)

TEXT BOOKS

REFERENCES
4. HEINE, R.W., LOPER, L.R., and ROSENTHAL, C, Principles of Metal Casting, TMH
5. MINKOFF, J., solidification and cast structure, wiley.1986
MODULE- I (12 hours)

MAINTENANCE CONCEPTS:
Objectives and functions – Tero technology – Reliability Centered Maintenance (RCM) – maintainability prediction – availability and system effectiveness- maintenance costs – maintenance organization, Minimal repair – maintenance types – balancing PM and breakdown maintenance- PM schedules: deviations on both sides of target values – PM schedules: functional characteristics – replacement models

MODULE- II (10 hours)

MODULE- III (13 hours)


DIAGNOSTIC MAINTENANCE: Leak detection-wear monitoring-Temperature monitoring-Vibration monitoring-Signature analysis-Shock monitoring-Lubricant-Analysis-Methodology-Equipments-Applications


TEXT BOOKS

REFERENCES
PEME5408 COMPOSITE MATERIALS

Module – I (14 hours)
1. Introduction:
Classification and characteristics of composite materials, mechanical behaviour of composites, constituents, Reinforcements, Matrices, Fillers, Additives, Applications and advantages of composites.
2. Processing:
Initial form of constituent materials, Manufacturing procedures for fibre-reinforced plastics, quality control.
3. Macromechanical Behaviour:
Stress strain relations of anisotropic materials - Engineering constants for orthotropic materials, Stress strain relations for specially orthotropic lamina. Transformation relationships for a lamina of arbitrary fibre orientation.

Module – II (12 hours)

Module – III (10 hours)
FRP Composite Laminate designation and codes, Macromechanical Behaviour of FRP Composite Laminates, Classical Lamination Theory. General Design Consideration and Suitable laminating Scheme.

Text Book

Reference Book:
3. Composite materials, Broutman & Crock,
Module-I Project Management Concepts and Needs Identification

Attributes of a Project, Project Life Cycle, The Project management Process, Benefits of Project Management, Needs Identification, Project Selection, Project organization, the project as part of the functional organization.

Project feasibility Analysis: Technical feasibility, commercial and financial visibility, Environment Analysis.

Module-II Project Planning and Scheduling:

Design of project management system; project work system; work breakdown structure, project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ GERT, Resource allocation, Crashing and Resource Sharing, capacity planning and expansion capacity decision.

Module III Project Monitoring and Control and Project Performance

Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators; Project Audit; Project Audit Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager.

Books:

1. Project Planning, Analysis, Selection, Financing, Prasana Chandra, TMH
2. Project Management, Grey, TMH.
3. Project Management, Richman, PHI
4. Project Management, Vasant Desai, HPH
5. Project Management, Bhavesh M.Patel, Vikash
PEME5304  TRIBOLOGY

MODULE- I  (12 hours)

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used. Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

MODULE -II  (11 hours)

Hydrodynamic theory of lubrication: Various theories of lubrication, petroffs equation, Reynold’s equation in two dimensions - Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydrodynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti-friction bearing.

MODULE- III  (12 hours)


TEXT BOOKS:
1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI
2. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co.

REFERENCE:
1. Introduction to Tribology of Bearings – B.C. Majumdar, S. Chand & Co.
PCMF7301 FLUID MECHANICS LABORATORY (0-0-3)

LIST OF EXPERIMENTS:

1. FLOW MEASUREMENT
   
   Calibration of Flow Measuring instruments
   Venturimeter,
   Orificemeter,
   Rotometer,
   Calibration of flows in
   Open channels
   Weirs and notches.
   Estimation of friction factor in flow through pipes.

2. PUMPS
   
   Determination of performance characteristics of pumps
   Centrifugal pumps,
   Submersible pumps
   Turbine pumps and
   Positive displacement pumps

3. TURBINES
   
   Determination of performance characteristics of turbines
   Reaction turbines
   Impulse turbines.

PCMF7302 MACHINE DESIGN SESSIONAL (0-0-3)

LIST OF EXPERIMENTS:

1. Design of coupling –Rigid & flexible type
2. Design of riveted joints (under axial & eccentric loading)
3. Design of Welded joints (under axial & eccentric loading)
4. Design of cotter & knuckle joint
5. Design & Analysis of leaf & Helical springs under various loading
6. Design of Piston
7. Design of Connected rod/crankshaft,
8. Design of Spur gear under various loading
9. Design of Helical & bevel gear under various loading
10. Design of Screw Jack under various loading
11. Practice in computer aided design of some of the above mentioned design using 3D Software
LIST OF EXPERIMENTS:
1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential
   20 gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker,
   Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axis symmetric bodies using Turn Table
   apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound
   pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and
   Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural
    frequency and verification of Laws of springs – Damping coefficient determination.
    b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.
    Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – Undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated
    Loads.
    b). Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
    b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.
6th Semester

PCME4404 PRODUCTION AND OPERATION MANAGEMENT (3-0-0)

Objective: The course aims at acquainting all engineering graduates irrespective of their specializations the basic issues and tools of managing production and operations functions of an organization.

Module-I (11 Hours)

Module II (13 Hours)
Group Technology
5. Forecasting : Principles and Method, Moving Average, weighted Moving Average, Exponential Smoothing, Winter’s Method for Seasonal Demand, Forecasting Error.

Module III (11 Hours)

Reference Book:
3. Aswathappa & Bhatt – Production & Operations Management, HPH.
5. Russell & Taylor - Operations Management, PHI Publication
7. E.E. Adam and R.J. Ebert “Production and Operations Management”, Prentice Hall of India
MODULE I
INTRODUCTION TO METAL FORMING: Classification of Forming Processes - Temperature in Metal working - Hot and Cold working - Introduction to the theory of Plastic Deformation.

THEORY AND PRACTICE OF BULK FORMING PROCESSES: Analysis of plastic deformation in Forging, Rolling, Extrusion and rod/wire drawing processes - Effect of friction, calculation of forces, work done - Process parameters, equipment used - Defects - applications - Recent advances in Forging, Rolling, Extrusion and drawing processes - Experimental techniques of evaluation of friction in metal forming.

MODULE II

MODULE III
POWDER METALLURGY FORMING: Overview of P/M technique - Advantages - applications - Powder perform forging - powder rolling - Tooling and process parameters.

TEXT BOOK

REFERENCES
Module-I  (12 hours)

INTRODUCTION: Tool design objectives - types of tools, Principles of design and construction of jigs and fixtures, principles of location and clamping, locating and clamping devices, Analysis of clamping force-Tolerance and error analysis.

JIGS: Different types of jigs - plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Drill bushes Design and development of Jigs for given components.

FIXTURES: General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given components.

MODULE- II  (12 hours)

PRESS WORKING:

MODULE –III  (11 hours)

DESIGN AND DEVELOPMENT OF DIES:

(Use of approved design data book is permitted)

TEXT BOOKS

REFERENCES
5. PSG College of Technology, Coimbatore - Design Data Handbook
PCMF 4303 CAD/CAM FOR MANUFACTURING ENGINEERING
(3-0-0)

MODULE I (11 hours)
Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal. Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

MODULE II (12 hours)

MODULE III (12 hours)
Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-no optical, computer aided testing, integration of CAQC with CAD/CAM. Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

TEXT BOOK:
1. CAD / CAM A Zimmers & P.Groover/PE/PHI
2. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH

REFERENCE BOOK:
1. Automation, Production systems & Computer integrated Manufacturing/ Groover/P.E
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. CAD/CAM: Concepts and Applications/Alavala/ PHI
PROFESSIONAL ELECTIVE – II

PEMF5304  PRECISION ENGINEERING  (3-0-0)

MODULE -I  
(12 hours)

MODULE- II  
(12 hours)

MODULE-III  
(11 hours)

TEXT BOOKS
2. Precision Engineering – R.L. Murthy

REFERENCE
1. Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K.
FEME6301  FINITE ELEMENT METHODS  (3-0-0)

Module – I  
(12 hours)
Review of 2-D and 3-D stress analyses, vibration, fluid flow and heat conduction problems.
FEM fundamental concepts, Variational principles, Rayleigh Ritz and Galerkin Methods.
Finite Element Modeling of one dimensional problems.
Finite Element Analysis of 2-D and 3-D framed structures.

Module – II  
(12 hours)
FEM formulation of 2-D and 3-D stress analysis problems.
Axisymmetric solids subjected to axisymmetric loadings.
Two-dimensional isoparametric elements and numerical integration.

Module – III  
(12 hours)
FE modeling of basic vibration problems.
Finite element modeling of fluid flow and heat conduction problems.
Computer programs: preprocessing and post processing.
Exposure to commercial FE codes such as ANSYS, NASTRAN and IDEAS etc.

Text Books
1. Finite Elements in Engineering, T.R.Chandruputla and A.D.Belegundu, PHI

Reference
1. Introduction to Finite Element Method, C.Desai and J.F.Abel, CBS publishers
3. Numerical Methods in Finite Element Analysis, K.J.Bathe and E.L.Wilson, PHI
PEMF5305  PLASTIC MOULD & DIE DESIGN  (3-0-0)

MODULE-I  (9 hours)
PRODUCT DESIGN: Basic Principles-Shrinkage-Flash lines-Undercuts-suggested Wall thickness-Draft-Tolerance-Moulded holes-threads-radius- moulded hinges-integral hinge-snap fits - product design thumb rules - case studies and product design.

MODULE-II  (14 hours)

MODULE-III  (12 hours)
EXTRUSION DIE DESIGN: Construction features of an extruder, Process, Characteristics of Polymer melt, Die geometry, Die head Pressure, characteristics of land length to Profile thickness, Extrudate die swell, Die materials, Classification of dies-Dies for Solid Section, Dies for Hollow Profiles, Blown film dies, Flat film dies, Parison dies, Wire and cable Coating dies, Spiral mandrel die, Fish tail die, Adjustable Core die

Text Books:
1. Injection Mould Design for Thermoplastic - By Pye, R.G.W
2. Injection Mould & Molding - By Dym
3. Injection Moulds – 130 Proven Design - By Gastrow, H
4. Plastics Product Design Engineering Hand Book - By Dubois, H
FREE ELECTIVE – II

PEME5308 NON-CONVENTIONAL ENERGY SOURCES (3-0-0)

Module I (10 Hours)


Module II (15 Hours)


Module III (15 Hours)

Miscellaneous Non-conventional Technologies


Text Book:
1. Non Conventional Energy Sources: B.M Khan, TMH Publications
2. Renewable Energy Sources and Emerging Technology: D.P.Kothari and etal., PHI

Reference:
3. Non Conventional Energy Sources: H.P.Garg
Module I (12 Hrs)
Water tube & fire tube boilers, circulating principles, forced circulation, critical pressure, superheaters, reheaters, attemperators, induced draught, forced draught and secondary air fans, boiler performance analysis and heat balance. Combustion systems, environmental protection – esp, cyclone separator, dust collector etc.

Module II (12 Hrs)
Rotary thermodynamic devices – steam turbines & their classifications – impulse & reaction type turbines, thermodynamics of compressible fluid-flow, equation and continuity – isentropic flow through nozzles, velocity diagram, blade efficiency, optimum velocity ratio, multi-staging, velocity & pressure compounding,

Module III (11 Hrs)


Text books:
2. P k Nag- power plant engg. - TMH publication
3. P.S. Ballaney- thermal engineering – khanna pub
4. Domkundwar & Arora- power plant engineering –.dhanpat rai & co.

Reference books:
1. Cengel --- Thermodynamics , 3/e ,tmh
2. ET-WAKIL—power plant engineering , mh
PEIT5301 E COMMERCE (3-0-0)

MODULE I:


MODULE II:

**E-commerce fundamentals:** Introduction, The e-commerce environment, The e-commerce marketplace, Focus on portals, Location of trading in the marketplace, Commercial arrangement for transactions, Focus on auctions, Business models for e-commerce, Revenue models, Focus on internet start-up companies-the dot-coms.

MODULE III:

**E-business infrastructure:** Introduction, What is the internet?, How does it work? Internet standards, Focus on who controls the internet, Managing e-business infrastructure, Focus on web service and service and service-oriented, Focus on new access devices,

**Text Book:**

**Reference Books:**
PCMF7304 TOOL DESIGN LABORATORY

TOOL DESIGN
1. Design and development of dies for Blanking and piercing operations.
2. Exercise on wire drawing die.
4. Exercise on Forging Die Design.
5. Exercise on Plastics Mould Design.
   a. Two Plate / Three plate
   b. Three Plate Mould

A. SIMULATION
1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration and Laplace Transforms

B. ANALYSIS
1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric components
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Transient analysis of spring mass system
9. Spectrum analysis of spring mass system
10. Thermal stress analysis of a axisymmetric component
11. Conductive heat transfer analysis of a 2D component
12. Convective heat transfer analysis of a 2D component
1. Microstructure analysis of steel (Mild, Medium carbon, High carbon, Hardened & Spheroidised Steel), Cast iron
2. Jominy and Quench test apparatus
3. Microstructure analysis of Non ferrous alloys
4. Heat treatment of steel
5. Cooling curve experiment
6. Liquid penetrant test
7. Ultrasonic flaw detection
8. Magnetic particle testing
9. Eddy current testing.
PCMF7306 MANUFACTURING TECHNOLOGY LABORATORY IV
(MECHATRONICS & MICROPROCESSOR LAB)

a) Microprocessor lab
1. Study of 8085 Microprocessor and 8051 Microcontroller trainer kits and identifying the components.
2. 8085 and 8051 Assembly language programs
   i) Arithmetic operation
   ii) Ascending/descending order and finding largest/ smallest number in an array.
3. 8085 and 8051 Assembly Language Program for code conversion
   i) BCD to binary
   ii) binary to BCD
4. 8051 Assembly Language Program for timer operations.
5. Interfacing of 8 bit A/D and D/A converters using 8085 and 8051
6. Stepper motor interface using 8085 and 8051
7. Display unit interface with 8051 and 8051

b) MECHATRONICS LABORATORY
1. Design and testing of the circuits such as
   i) Pressure control valves
   ii) Flow control valves
   iii) Directional control valves
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic hydraulics, pneumatic and electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5. Speed measurement using Inductive pickup/Proximity sensor.
6. Temperature measurement using thermocouple, thermistor and RTD
7. Servo controller interfacing i) open loop
   ii) closed loop
8. PID controller interfacing
9. Computer controlled relays, solenoids and DC motors
10. Study of CMM based instrumentation
11. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using
12. LAB VIEW software

(Any 5 Each from both)
# MANUFACTURING ENGINEERING & TECHNOLOGY

## 7th & 8th SEMESTERS

### 7th SEMESTER

<table>
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<th>Code</th>
<th>Subject</th>
<th>Contact Hours</th>
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<tr>
<td>PCMF4401</td>
<td>Non Traditional Machining</td>
<td>3-0-0</td>
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<tr>
<td>PCMF4402</td>
<td>Statistical Quality Control &amp; Reliability</td>
<td>3-0-0</td>
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<tr>
<td>PCMF4403</td>
<td>Machine Tool Design</td>
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<td>PEMF5402</td>
<td>Surface Engineering</td>
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<td>PEMF5403</td>
<td>Instrumentation &amp; Control Engineering</td>
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<td>Rapid Prototyping</td>
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<td>PEME5407</td>
<td>Computational Fluid Dynamics</td>
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### Credits (Theory)

- 7th Semester: 18 credits
- 8th Semester: 12 credits

### Practical/Sessionals

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<td>Comprehensive Viva voce</td>
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### Credits (Practicals / Sessionals)

- 7th Semester: 6 credits
- 8th Semester: 10 credits

### Total Semester Credits

- 7th Semester: 24 credits
- 8th Semester: 22 credits

### Total Cumulative Credits

- 182 credits
- 204 credits

************
PCMF4401 NON TRADITIONAL MACHINING (3-0-0)

MODULE -I (11 hours)
INTRODUCTION: History, Classification, comparison between conventional and Non-conventional machining process selection. Ultra sonic machining (USM): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design: Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

MODULE –II (12 hours)
ABRASIVE JET MACHINING (AJM): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

ELECTROCHEMICAL MACHINING (ECM): Introduction, study of ECM machine, elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

MODULE –III (12 hours)
ELECTRICAL DISCHARGE MACHINING (EDM): Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design choice of machining operation electrode material selection, under sizing and length of electrode, machining time. Application EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.


TEXT BOOKS:
1. Advanced machining processes / VK Jain/ Allied Publishers

REFERENCE BOOKS:
1. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH
MODULE -I  
STATISTICAL QUALITY CONTROL: Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes - Cumulative sum and Exponentially weighted moving average control charts - Other SPC Techniques – Process - Capability Analysis - Six sigma concept.


MODULE –II  
RELIABILITY ENGINEERING: Definition of reliability – Performance and reliability - Reliability requirements – Life Testing - System life cycle – Mean time between failures – Mean time to failure - Mortality Curve - Availability – Maintainability.


MODULE –III  
RELIABILITY PREDICTION AND MANAGEMENT:

TEXT BOOKS

REFERENCES
PCMF4403 MACHINE TOOL DESIGN  (3-0-0)

MODULE-I  (14 hours)
Introduction: Developments in machine tools, classification of machine tools, General requirement of machine tool design. Machine tool design process. A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system e.g. pumps, cylinder, directional control valves, pressure valves etc.

Module-II  (11 hours)
Kinematics of machine tools:
Types of drives, selection and design requirements, regulation of Speed and Feed rates: Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.
Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, table, column and housing, Model technique in design. Design of guideways and power screws: Basic guideway profiles, Designing guideway for stiffness a wear resistance & hydrostatic and antifriction guideways. Design of sliding friction power Screws. Design of spindlier & spindle supports. Layout of bearings, selection of bearings machine tools

Module-III  (10 hours)

TEXT BOOKS
PROFESSIONAL ELECTIVE – III(ANY ONE)

PEMF5401 PRODUCT DESIGN & DEVELOPMENT (3-0-0)

MODULE -I (11 hours)


MODULE -II (14 hours)


MODULE -III (10 hours)

TEXT BOOK

REFERENCES
PEMF5402 SURFACE ENGINEERING (3-0-0)

MODULE –I (10 hours)
Definition and Scope of Surface Coating: Purpose of surface coating, resistance / wear hardness, corrosion resistance, weather resistance, surface coating for conduction and insulation, aesthetics and surface finish, etc. Pretreatment for Surface Coating: Degreasing, pickling, phosphating, descaling, cleaning, etc. Metal Coatings: Characteristics; Operational parameters, application and limitations of galvanizing, sherardising, chromating, zinc and aluminum spraying. Hot dipping, gas spraying, arc spraying, plasma spraying.

MODULE- II (14 hours)
Electro Plating: Vat, barrel, automatic reverse current plating, equipment, operational parameters and electrolytes for electro plating; productivity comparison between metal coating and electroplating, base metals and plating metals, application and limitations. Ceramic Coating: Characteristics of ceramic coating, types of ceramics used for coating, base materials, methods of ceramic coating, vitreous enameling. Polymer Coating: Characteristics, types of polymers and their relative merits and demerits, base materials for polymer coating, equipment for polymer coating; types of polymer coating, spraying, dipping, fluidized bed, powder spraying; use of extrusion, principles, selection of polymers.

MODULE –III (11 hours)
Paint Coating: Types of paints, their characteristics and properties, selection of paints; technology of application of paints, brush, spray, electrostatic spray, airless spray, dipping flow coating, rumbling, roller coating, etc.

Curing of Paint Coatings: air drying, catalyst drying, convention staving, infrared staving, electron beam curing, UV curing. Miscellaneous Processes: Chemical coloring, blackening, bluing, etc; chromating, chemical polishing, lead sheathing, Newer coating processes and advances in surface technology.

TEXT BOOKS:


PEMF5403 INSTRUMENTATION & CONTROL ENGINEERING (3-0-0)

MODULE –I          (12 hours)
INTRODUCTION TO INSTRUMENTATION
Function block of instrumentation-Intelligent instruments -I/O elements-Automatic test equipment records -D/A converters-A/D converters-Types.

ADAPTIVE CONTROL SYSTEMS: Definition of AC types-AC applications-Self tuning control systems-Real time parameter estimation-Expert system and neural network-Fuzzy control.

MODULE –II          (10 hours)

MODULE -III          (13 hours)
COMPUTER CONTROL SYSTEM
Data acquisition system-Supervisory control-Direct Digital control-Programmable logic controls-Ladder logic diagrams-communication in PLC.

DIAGNOSTIC AND CONDITION MONITORING METHODS
Objectives of machine diagnostics-causes of failure in machine tools-Distribution of fault occurrences-Aims of monitoring-Telephone diagnostic method applied to CNC machine.

Text Book

References:
PROFESSIONAL ELECTIVE – IV (ANY ONE)

PEMF5404 RAPID PROTOTYPING (3-0-0)

MODULE –I (12 hours)

LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS: Classification – Liquid based system - Stereo lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

MODULE –II (11 hours)

MODULE -III (12 hours)

REVERSEENGINEERING AND NEW TECHNOLOGIES: Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-pre-processing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TEXT BOOKS

REFERENCES
Module-I
Basics of Computational Fluid Dynamics (CFD)- Introduction to One dimensional computation: Finite difference methods (FDM)-Finite element method(FEM)-Finite volume method(FVM). Solution of Discretised Equations: The tri-diagonal matrix algorithm (Thomas Algorithm for one dimensional case)


Module-II

Module-III

Text Book

Reference Books
PEME5407 MECHATRONICS (3-0-0)


TEXT BOOK:

REFERENCE BOOKS:
3. Dan Neculesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint)
FREE ELECTIVE – III (ANY ONE)

FEME6401 HUMAN RESOURCES MANAGEMENT (3-0-0)

MODULE I

MODULE II


Text Books

Reference Books


TEXT BOOK

REFERENCE BOOKS
HMM3401 ENTREPRENEURSHIP DEVELOPMENT (3-0-0)

MODULE I


MODULE II


MODULE III

SUPPORT TO ENTREPRENEURS - Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and SubContracting.

TEXT BOOKS:

REFERENCES:
PCMF7401 PROJECT- 1
The main objective us give the students hands on training in the fabrication of one or more component working model which has been designed by them. The students maybe grouped into small groups and work under a Project supervisor. The components to be fabricated may be decided in consultation with the Supervisor and if possible with an industry.

PCMF7402 MANUFACTURING TECHNOLOGY LAB –V
(COMPUTER AIDED MANUFACTURING)
1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe
   a. Part programming for Linear and Circular interpolation, Chamfering and Grooving
   b. Part programming using standard canned cycles for Straight Turning, Step Turning, Facing, Taper turning and Thread cutting & Machining Of internal Surface.

2. MANUAL PART PROGRAMMING (using G and M codes) in CNC milling
   c. Part programming for Linear and Circular interpolation and Contour motions.
   d. Part programming involving canned cycles for Drilling, Slotting, Peck drilling, Boring & Other Canned Cycles.

3. SIMULATION AND NC CODE GENERATION
   e. NC code generation using CAD / CAM softwares - Post processing for standard CNC Controls like FANUC, Hiedenhain etc.
   f. Electro Discharge Machining Process parameter Selection.
   g. Wire cut EDM Machining and process study.
   h. Study of Laser Engraving machine
   i. Robot Programming – Material handling Application
   j. PLC Ladder logic programming.

PCMF7403 SEMINAR-1 (TECHNICAL)
8th SEMESTER

PCMF4404 FLEXIBLE MANUFACTURING SYSTEM & ROBOTICS

(3-0-0)

MODULE –I  
(12 Hours)

MODULE –II  
(12 Hours)

MODULE- III  
(11 Hours)

TEXT BOOKS:


REFERENCE BOOKS:

FEMT6041 TOTAL QUALITY MANAGEMENT (3-0-0)

MODULE I
INTRODUCTION- Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.


MODULE II
STATISTICAL PROCESS CONTROL - The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.


MODULE III

TEXT BOOK

REFERENCE BOOKS
PROFESSIONAL ELECTIVE – V (ANY ONE)

PEMF5405 STATISTICAL METHODS & DESIGN OF EXPERIMENTS (3-0-0)

MODULE I (13 hours)

RANDOM VARIABLES Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

TWO-DIMENSIONAL RANDOM VARIABLES : Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

MODULE II (12 hours)


MODULE III (10 hours)

DESIGN OF EXPERIMENTS: Completely randomized design – Randomized block design – Latin square design - 2²-factorial design- Test of Significance and Model lack of fit

TEXT BOOKS


PEMF5406 COMPUTER INTEGRATED MANUFACTURING (3-0-0)

MODULE - I (12 hours)

MODULE - II (11 hours)

MODULE - III (12 hours)

TEXT BOOKS

REFERENCES
Module-I
14 Lectures

Overview of MEMS and Microsystems. (Chapter 1 of Text Book 1)

Micromachining Techniques: Silicon as material for micromachining, Photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book 2)

Module II
10 lectures

Micro system Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

Module III
15 Lectures

MEMS Applications: Mechanical sensors and actuators: Piezo resistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators. (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)

Optical: Micro-lens, Micro-mirror, Optical switch (Section 7.5 to 7.7 of Text Book 2)

Radio frequency MEMS: Inductor, Varactor, Filter, Resonator. (Section 9.3 to 9.7 of Text Book 2)

Micro fluidics: Capillary action, Micro pumping, Electrowetting, Lab-on-a-chip. (Section 10.1 to 10.8 of Text Book 2)

Text Books:


Reference Book:
FREE ELECTIVE – IV (ANY ONE)
FEMF6401 SUPPLY CHAIN MANAGEMENT (3-0-0)

MODULE I:

MODULE II:

Procurement Management In Supply Chain: Introduction, Purchasing Cycle, Type and classification of Purchases, Inventory Models, Economic Order Quantity, Practicalities, Safety Stock, Fixed Order interval System and Fixed Order Quantity System, Material Requirements Planning (MRP), and Just in Time (JIT) Vendor Managed Inventory (VMI) - VMI Business Model, Challenges and Limitations of VMI, Just in Time (JIT)-II, Multi-tier Supplier Partnership

MODULE III:

TEXT BOOKS:

REFERENCE BOOKS:
PETX5412 MANAGEMENT INFORMATION SYSTEM

Module – I
Overview: Definition of MIS, Data processing and MIS, Characteristics of MIS, Need / importance of MIS in organization, Limitations of MIS; MIS and other disciplines
Data and Information; Characteristics of Information; Types of Information – Operational, Tactical and Strategic information; Managers as Information Processors;
System Approach: MIS as a system, Sub-systems of MIS – Activity sub-systems, Functional sub-system
Decision Making: Decision-making under certainty, risk and uncertainty; Phases of Decision-making Process; Decision Models - Classical Economic Model, Administrative Model; Organizational Decision-making
Planning for development of MIS: Feasibility Analysis – Technical, Economic, Motivational, Schedule and Operational Feasibility; MIS development as a project;

Module – II
Overview of System Life Cycle Models – Waterfall model, Prototyping model and Spiral model
System Analysis and Design (SAD): Purpose, Requirement engineering, Typical content of System Requirement Specification (SRS), System Design – high level design and low level design, Characteristics of good design – coupling and cohesion
Overview of tools used in SAD – Context diagram, Data Flow Diagram (DFD), Data Dictionary, ER diagram, Structure charts, HIPO documentation, Decision Table, Decision Tree, Pseudocode

Module – III
MIS in Organization: MIS in Marketing; Manufacturing; HRM; Accounting and Finance, Enterprise Resource Planning (ERP) System.
Business Intelligence (BI): Role of BI in marketing, finance, human resource, and manufacturing;
Overview of DSS, Data Mining and Data Warehouse
Implementation of MIS: Critical Success Factor
Information System Security, Privacy, Social and Ethical issues

Books:
2. Information Systems for Modern Management, Murdick, Ross & Claggett, PHI
4. Management Information System, James O Brian, TMH
5. Management Information Systems, A K Gupta, Sultan Chand & Sons
HSSM3403 MARKETING MANAGEMENT

Module I (10 hours)
Marketing Management: Concept, Process, Functions and relevance in the current context.
Marketing Environment: Elements of micro and macro environment
Competition Analysis: Factors contributing to competition, porter’s five forces model, Identifying and analyzing competitors.
Market Research and Information Systems: Research Process, The Internet and World Wide Web based Information collection and processing, Database, Data Warehouses and Data Mining, Global Market Research.
Consumer Behavior: Factors influencing consumer behavior, consumer decision process. Organizational buying behaviour.

Module II (10 hours)
Market Demand Forecasting: Key Terms, Forecasting Tools: Short term tools: Moving average and Exponential smoothing methods, Long-term forecasting Tools: Time series analysis, Econometrics methods, Qualitative tools : Buying Intention Survey, Sales Force Opinion and Delphi Techniques.

Module – III (10 hours)
Pricing Decision: Objectives and Factors influencing pricing, Pricing method and strategies.
Integrated Marketing Communication (IMC)- Concept of IMC, the marketing communication process, Promotion Mix, elements of promotion mix, Direct marketing.
Channels of Distributions: Types of intermediaries, functions of distribution channels, channel levels, Designing Distribution Channels, Physical Distribution, Supply Chain Management (Basic only).
Trends in Marketing: Green Marketing, Customer Relationship Management, E-marketing, Rural Marketing and Service Marketing (concepts only)

Text Book:
1. Etzel , Walker , Stanton and Pandit, Marketing, 14/e, Tata McGraw Hill.

Reference
PRACTICALS/SESSIONALS

PCMF7404 PROJECT

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

PCMF7405 ENTREPRENEURSHIP PROJECT

PCMF7406 SEMINAR-2 (TECHNICAL)

PCMF7407 COMPREHENSIVE VIVA VOICE