
3rd SEMESTER

PE3001 METALLURGY (3 Credits)

Module 1

Review of Engineering and industrial materials – their classification and application, recent development in metallic materials

Module 2

A brief description of iron and steel making – Raw materials Principles and processes

Module 3

Isomorphous, eutectic and peritectic systems, Iron – Carbon equilibrium diagram, classification of steels, effect of alloying elements on steels. Tool steels

Module 4

Isothermal decomposition of austenite (TTT Curve), transformation of austenite upon continuous cooling, annealing, normalising, hardening, tempering, hardenability of steel, Jominey hardening test, end quench test, surface hardening, case hardening, recovery, recrystallisation and grain growth

Module 5

Grey iron, S.G. Iron, white iron, malleable iron. Principles of corrosion, forms of corrosion, factors affecting the rate of corrosion, corrosive agents, protection against corrosion;

Module 6

Weld metal zone, HAZ, parent metal zone, Joint efficiency, weldability, concepts of ductile and brittle fractures

Module 7

Properties and applications of Non ferrous Metals and Alloys-Al & Cu

Text Books:

1. **Elements of Metallurgy** D. Swaroop
2. **Material Science and Engineering** V. Raghvan
3. **Metallurgy for Engineers** L.C.Rollagon

PE3003 OPERATIONS RESEARCH (4 Credits)

(Treatment of the subject to be application oriented, theorems and derivations are not necessary)

Module 1

Scope and Limitation of O.R.

Module 2

Linear Programming

Mathematical formulation of the problem
Graphic solution, the simplex method
Big-M method, concept of duality, dual simplex method

Module 3

Transportation Model

Basic feasible solution by different methods, finding optimal solutions, degeneracy in transportation problems, unbalanced transportation problems

Module 4

Assignment Model

Balanced and unbalanced assignments, assignment to given schedules

Module 5

Sequencing

Processing of 2 jobs through machines –graphical method, Processing of n jobs through two machines, processing n jobs through three machines

Module 6

Queuing Model

Queuing systems and their characteristics, The M/M/1/FIFO/Queuing system

Module 7

Games Theory

Two-persons zero sum games, Pure and mixed strategies, Rules of dominance, Solution methods without saddle point

Text Books

1. **Operations Research** Kanti Swaroop
2. **Operations Research** P.K. Gupta & D. S. Hira

References

1. **Linear Programming** Hadely
2. **Quantitative Technique in management** N.D. Vohra

4th SEMESTER

PE4001 MANUFACTURING PROCESSES – I (3 Credits)

Module 1

Theory of Metal Cutting

Geometry of single point cutting tool, Orthogonal and oblique cutting, Tool forces in orthogonal cutting, types of chips,

Module 2

Machinability, tool failure, tool life, cutting fluids and cutting tool materials

Module 3

Machine Tools

Constructional features, specification, operations and drives of lathe, working principles of capstan and Turret lathes, Shaper, Planer, & Slotter.

Module 4

Constructional features, specification, operations and drives of milling & drilling machine, indexing in milling operations

Module 5

Grinding and finishing operations

Cylindrical, surface and centreless grinding; Broaching, lapping, honing and buffing

Module 6

Gear cutting by forming and generating methods.

Module 7

Introduction to Modern Manufacturing Processes

Fundamental principles, application possibilities, process parameters, and operational characteristics of Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Ultrasonic Machining (USM), Chemical Machining (CHM).

Text Books

1.	**Workshop Technology –Vol. II**	B S Raghuwanshi
2.	**Production Technology -Vol. II**	OP Khanna & M Lal
3.	**Elements of workshop technology- Vol. II**	Hajra Choudhry
4.	**Modern Machining Processes**	P. C. Pandey, H. S. Shan, TMH
5.	**Non-conventional Machining**	P. K. Mishra ,Narosa Publishing House
6.	**New Technology**	A. Bhattacharyya, IE(I)

Reference Books

1.	**Production Technology hand book**	HMT
2.	**Principles of manufacturing materials and processes**	J S Campbell
3.	**Principles of Manufacturing technology**	P N Rao (Part I)

PE4003 METROLOGY (3 Credits)

Module 1

Standards of Measurement

Historical development, system of measurement, line, end & wavelength standards, type and source of measurement errors

Module 2

Comparators

Principle and uses of mechanical, optical, Electrical, electronic and pneumatic Comparators

Module 3

Limits, Fits & Limit Gauge Design

Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Indian standard system , type of plain limit gauges, design of plain limit gauges, Taylor's principle of gauging

Module 4

Optics in Metrology

Principle of interferometer, concept of optical flat, projector, microscope, autocollimator and interferometer

Module 5

Screw thread And Gear Measurement

Measurement of minor, major, effective diameter, pitch and thread angle of screw threads, gear tooth thickness & pitch measurement, involutes profile testing of gear

Module 6

Geometrical Form and surface Finish

Straightness, flatness and squareness and circularity tests, numerical evaluation measurement of surface finish, construction detail and working of Taylor – Hobson instrument

Module 7

Machine Tool Metrology

Types of machine tool tests, alignment tests for lathe, milling and drilling machine tools

Text Books

1. **A Text book of Engineering Metrology** — I. C. Gupta , Dhanpat Rai , New Delhi
2. **Engineering Metrology** — R.K. Jain ,Khanna Pub., New Delhi

References

1. **Engineering Metrology** — K. J. Hume
2. **Engineering Metrology** — M. Mahajan , Dhanpat Rai & Co. New Delhi

ME 4007 THEORY OF MACHINES (PRODUCTION ENGG.) IV SEM.

Module-1: Definitions; Link or element of a machine, Kinematic pair, Kinematic chain, Mechanism, Inversion, Machine. Degree of freedom, Inversions of four bar chain, single slider crank chain and Double slider crank chain. Straight line motion mechanism and copying mechanism. (5)

Module 2: Velocity and acceleration diagram of planar mechanism including corriolis component. Relative velocity method, Instantaneous centre method. Klein's construction and Analytical treatment of single slider crank mechanism. (10)

Module 3: Static force analysis, Dynamic force analysis, Equivalent two-mass system. (5)

Module 4: Flywheel: Turning moment on crankshaft, Turning moment diagram, Fluctuation of speed and energy and determination of moment of inertia of flywheel. (5)

Module 5: Fundamental law of gearing, classification and basic terminology, Involute tooth profiles, spur gears. Gear trains; simple, compound and epicyclic gear trains. (8)

Module 6: Cams: various types of cams, various types of followers, Displacement –time, velocity-time and acceleration-time diagrams. Graphical determination of cam profiles, specified cam profiles. (6)

Module7: Vibrations: Linear single degree of fresdom systems, Free undamped and free damped longitudinal vibration, Transverse vibrations in shaft, torsional vibration, Turo-rotor system and three-rotor system. (6)

Text Book:

1. Theory of Machine by Thomas Beven

Reference Books:

1. Theory of Machines and Mechanism by Ghosh and Malik
2. Mechanism and Machine Theory by J.S. Rao and R.V. Dukkibati
3. Theory of Machine by S.S. Rattan, Tata McGrow Hill.

5th SEMESTER

PE5001 MANUFACTURING PROCESSES – II (3 Credits)

Module 1

Introduction to foundry process and its importance, Patterns, pattern materials, types of patterns, pattern allowances, mould and core making, properties of molding and core sands. Sand testing, machine molding, gating, risers and solidification of casting, design of gating systems.

Module 2

Centrifugal casting, investment casting, die casting and shell molding

Module 3

Working principle and operation of cupola, cleaning of casting, inspection of casting, casting defects

Module 4

Principle, working and application of oxy- acetylene gas welding and gas cutting, electric arc welding, MMAW

Module 5

SAW, MIG, electroslag, TIG and plasma arc welding, thermit welding, and solid state welding.

Module 6

Resistance welding, spot, seam, projection and butt welding, soldering and brazing

Module 7

Fundamental principles, application possibilities, process parameters, and operational characteristics of Electrochemical machining (ECM), Electrochemical Grinding (ECG), Laser Beam and Electron Beam machining and welding, Electro Discharge Machining (EDM).

Text Books:

1. **Foundry, Forming and Welding** P.N. Rao, Tata Mc Graw- Hill
2. **Text book of welding technology** O.P. Khanna
3. **A course in workshop Technology** Vol. I B.S. Raghuvansi, Dhanpat Rai & Co.
4. **Modern Machining Processes** P. C. Pandey, H. S. Shan, Tata McGraw-Hill
5. **Non-conventional Machining** P. K. Mishra ,Narosa Publishing House
6. **New Technology** A. Bhattacharyya, IE(I)

References

1. **Foundry technology** K.P. Sinha and D.B. Goel Standard publishers, Delhi
2. **Welding and welding Technology** Richard L. Little (TMH Edition)
3. **Metal casting** Rossenthal, Tata Mc Graw- Hill

PE5003 MACHINE TOOL DESIGN (4 Credits)

Module 1

Introduction

Classification of machine tools, basic motion and general requirements of machine tool design

Module 2

Kinematics of Machine Tools

Types of drives, selection and design requirements, stepped and stepless regulation

Module 3

Layout of spindle speeds, preferred numbers, structure diagram, ray diagram, design of gear box for speed and feed

Module 4

Design of Machine Tool Structures

Compliance, stiffness and rigidity, design criterion, materials and basic design procedures for beds, tables and columns

Module 5

Machine Tool Slides, Guideways and Spindle

Function, requirements, constructional features, design criterion and tribological aspects of machine tool guideways and spindles, antifriction and roller slides

Module 6

Machine Tool Vibrations

Sources, effects and elimination of vibration, chatter

Module 7

Control Systems in Machine Tools

Control systems for changing speeds and feeds, ergonomic considerations applied to the design of control members

Text Books

1. **Machine tool design** N.K. Mehta, Tata McGraw-Hill Pub. Co.
2. **Design of machine tools** S.K. Basu & D.K. Pal, Oxford & IBH
3. **Principles of Machine tools** G.C. Sen. & A. Bhattacharyya

PRESENT SYLLBUS

PE5005 STATISTICAL QUALITY CONTROL (3 Credits)

Module 1

Introduction to Quality Control, Objective, Applications and Cost Consideration, Graphical and Analytical Methods for Central Tendency and Dispersion

Module 2

General Theory of Control Charts, Theory and Application of Control Charts for Averages, Range, Standard Deviation, Fraction Defective and Number of Defects, Process Capability Study, Interpretation of Control Chart

Module 3

100% Sampling Vs. Statistical Sampling, Elementary Concepts of Acceptance Sampling by Attributes, Concept and Characteristics of O.C. Curves

Module 4

Single, Double and Multiple Sampling Plans, Construction and Use of O.C. Curves for Sampling Plans, MIL – STD Plans, Sequential Sampling Plan

Module 5

Basic Concept of Reliability, Reliability and Hazard Functions for Well-Known Distributions, System Reliability, Reliability Improvement

Module 6

Concept of Quality Circle and Quality Loop, ISO–9000 Quality Systems, Quality Audit, Quality Costs and Cost of Quality, Six–Sigma Technique

Module 7

Total Quality Control: Basic Approach, Deming Theory, Quality and Competitiveness in a Global Market Place, Establishing a Quality Culture and Customer Focus, Employee Involvement

Text Books:

1. **Statistical Quality control** — M. Mahajan, Dhanpat Rai & Sons
2. **Mechanical Reliability** — L.S. Srinath, Affiliated East – West Press
3. **Statistical Quality Control & Reliability** — D.H. Besterfield, Prentice Hall
4. **Total Quality Management** — D.H. Besterfield, Prentice Hall

PE 5007 WORK STUDY & ERGONOMICS (3 Credits)

Module 1

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

Module 2

Method Engineering

Definition, objectives and methodology of method engineering, Plant layout, types of layout problems, factors affecting plant layout, types of plant layout, techniques and tools of layout, Types of flow patterns

Module 3

Motion Economy & Analysis

Principles of motion economy and methodology of motion analysis

Module 4

Work Measurement

Definition, objective and different methods of work measurement, Work Sampling

Module 5

Job Evaluation, Merit Rating, Wages & Salary

Definition, objectives and techniques of job evaluation and merit rating.

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

Module 6

Ergonomics

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

Module 7

Material handling

Material handling, types of load, objectives and principles of material handling, Diagnosis and analysis of handling problems, material handling equipment and their selection

Text Books

1. **Motion & Time Study** Barnes R.M.
2. **Work Study** O. P. Khanna

Reference Books

1. **Work Study** I. L. O.

6th SEMESTER

PE6001 TOOL DESIGN (3 Credits)

Module 1

Jigs & Fixtures: Principal of design and construction, Location and clamping

Module 2

Basic concept for design of turning, Milling, Drilling & Indexing Jigs and fixtures

Module 3

Classification of dies, components of dies assembly, Simple dies, compound dies, combination dies and progressive dies

Module 4

Punch and die clearance, centre of pressure, calculation of blank diameter

Module 5

Design of tools for the production of holes, surfaces of revolution, and flat surfaces like single point tools, form tools, drills, milling cutters

Module 6 & 7

Materials for cutting tools, cutting dies and forming dies, Economics of Tooling

Text Books

1.	**Production Engineering Design (Tool Design)**	Umesh Chandra & Surender Kumar, Satya Prakashan, New Delhi
2.	**Tool Design**	C. Donaldson, G.H.Lecain and V.C.Goold, Tata McGraw Hill

Reference Books:

1.	**Principles of Tool Design**	S.K. Basu
2.	**Jigs & Fixtures**	Fred H. Colvin
3.	**Handbook, Fundamentals of Tool Design**	ASTME
4.	**Basic Die Making**	Osterguard E., Mc-Graw Hill Book Co.
5.	**Metal Cutting & Tool Design**	V.Arshinov, Mir Publication.
6.	**Design and Production of Metal-Cutting Tools**	P.Rodin, Mir Publishers, Moscow.
7.	**Fundamentals of Tool Design**	Frank W. Wilson
8.	**Properties and Selection of Tool Material**	Kortesoja, Victor A., ASM.

PE6003 MATERIAL DEFORMATION PROCESSES (3Credits)

Module 1

Basic deformation processes
Basic concepts of hot and cold working processes and forming operations.

Module 2

Theory of Plasticity
State of stress at a point, equilibrium equations, stress tensor, spherical tensor and deviator stress tensor, principal stress, deformation tensor
Engineering and true stress –strain, flow curve, idealized stress-strain model, plastic deformation equations, levy–mises equations, prandlt–reuss equations, strain hardening, strain rate and bauschinger effects

Module 3

Flow Rule and Yield Criterion
Velocity field and strain rate, compatibility equation, von – mises and tresca yield criterion, biaxial and triaxial yield surfaces, experimental verification of yield criterion, lode–stress parameter

Module 4

Friction and Lubrication
Interfacial friction laws–Coulombs friction law, constant shear factor law, composite friction law and hydrodynamic friction law, friction mechanism during plastic deformation, lubrication mechanisms–boundary, hydrodynamic and solid lubrication, metal working lubricants–types and characteristics

Module 5

Plain Strain Deformation Processes
Basic concepts of slip-line method, slab method (equilibrium technique) and energy method (upper bound technique), analysis of following deformation processes
Forging of strip: pressure distribution and forging load
Rolling of strip: pressure distribution, roll–separating force and driving torque

Module 6

Axi-Symmetric Deformation Processes
Analysis of following deformation processes:-
Forging of disc: pressure distribution and forging load
Extrusion of cylindrical rod: extrusion load and frictional power loss
Drawing of cylindrical wire: drawing load and maximum allowable reduction

Module 7

Emerging Deformation Processes
Isothermal forging, water hammer forging, liquid metal forging (squeeze casting), continuous extrusion (conform extrusion), hydro–static extrusion, hydro–dynamic wire drawing, spray forming, explosive forming

Textbooks:

1. **Principle of Industrial Metal Working** G.W. Rowe, Edward Arnold , London
2. **Principles of Metal Working** S. Kumar, IBH & Co., New Delhi

References

1. **Engineering Plasticity** R.A. C. Slater, Macmilan, USA
2. **Metal Working Processes and Analysis** B. Avitzur, McGraw Hill, USA

As approved by board of studies (09/06/2011)

PE6005 PRODUCTION PLANNING & CONTROL (3 Credits)

Module 1

Introduction to Production Planning and Control

Production system, type of manufacturing systems and their characteristics, objectives and functions of production planning and control

Module 2

Preplanning

Demand forecasting, common techniques of demand forecasting, estimating factors of production, product mix and batch size decisions, aggregate planning

Module 3

Production Planning

Routing, Loading and scheduling with their different techniques, dispatching, Progress Report, Expediting and corrective measures

Module 4

Inventory Control

Field and scope of inventory control, inventory types and classification, Inventory control models, static model, dynamic model both deterministic and stochastic, Economic lot size, reorder point and their application,

Module 5

Materials management & purchasing

ABC analysis, VED analysis, modern practices in purchasing and store Keeping, concept of productivity

Module 6

Facility design

facility design process, facility design problems and their analysis, Factors affecting the location and site selection, techno economic analysis, multi-plant location, Concept of location theory and models.

Module 7

Plant maintenance

Importance of maintenance in plant, types of maintenance, inspection decisions, economics of maintenance, evaluation of maintenance policy, terotechnology .

Text Books

1. **Production and Inventory control** G.W. Plossel
2. **Principles and Design of Production Control Systems** E.D. Scheele, W.L. Westerman and R.J. Wimment
3. **Production Control Engineering** D. K. Corke
4. **Operation Research** Kanti Swarup

PE6007 MANUFACTURING AUTOMATION AND ROBOTICS (3 Credits)

Module 1

Manufacturing automation, components and types of automation, automation scenario and factory configuration, role of mechatronics in factory automation.

Module 2

Basic ideas, classification and structure of NC systems, NC-coordinate system, Constructional features and feedback devices for CNC machine tools, part programming and related languages, DNC and adaptive control.

Module 3

Electric and servo control in machine tools, stepper motor, PLC, transfer mechanism, buffer storage and control functions for transfer devices, feeding mechanism definition and concept, flexible automation.

Module 4

Computer integrated manufacturing, Flexible manufacturing systems: concept, need, structure & operation, objectives and benefits.

Module 5

Robot technology: basic elements, classification, physical configuration, basic robot motions, robot's specifications, end effector /grippers.

Module 6

Robot applications: application characteristics and areas such as material handling, welding, assembly, inspection, processing operation, spray painting etc

Module 7

Planning and implementation of robotized and FMS projects

Text Books

1. **Automation, Production System, and CIM** — M.P. Groover
2. **CNC Machines** — P. Radhakrishnan
3. Robot **Technology** — M.P. Groover

References

1. **Numerical Control of Machine Tools** — Y. Koren
2. **Technology of CAD/CAM** — A.K. Jha and S. Kumar
3. **Manufacturing Technology II** — P.N. Rao
4. **Industrial Robots and CIM** — Surender Kumar
5. **Robotics for Engineers** — **Yoram Koren ,McGraw Hill ,USA**
6. **Robot Technology Fundamentals** — **James G. Keramas**

7th SEMESTER

ELLECTIVE –I (Any Two from the following) (6 Credits)

PE7001 ENTERPRISE RESOURSCE PLANNING (3 Credits)

Module 1

Evolution, characteristics, features and need of ERP

Module 2

Enterprise modeling, information mapping and integration for ERP

Module 3

Definition, scope and benefits of supply chain management, performance of supply chain, role of supply chain in ERP

Module 4

Business reengineering, GERP, process improvement and process innovation, failure minimization of BPR projects, information technology assessment for ERP, ERP domain, integrated SAP model

Module 5

Technologies in ERP system, electronic data interchange, mapping of data base, EDI services, message configuration

Module 6

Selection & implementation of ERP, approaches to ERP selection,

Module 7

Methodology for ERP implementation, factors for successful implementation

Text Books

1. **Enterprise Resource Planning** Ravishankar and S. Jaiswal, Galgotia Publication Pvt. Ltd.

PE7003 PROCESS ENGINEERING (3 Credits)

Module 1

Introduction to process planning, Design and manufacture cycle, Process planning - the design/manufacture interface, Process planning activities, Process planning verses production planning.

Module 2

Process planning methods, Manual process planning, Experience-based process planning, Part design/drawing interpretation, Basic process planning terminology, Equivalent parts - interchangeability and standardization, Concept of dimensional chain, Dimensional and Tolerance analysis

Module 3

Process selection, Process capability analysis, Process and operations sequencing, Calculation of process parameters, Process re-engineering, Preparation of process sheet,

Module 4

Expert systems and their use in developing process planning systems,

Module 5

Computer-aided process planning (CAPP), Variant process planning, Generative and dynamic CAPP, Forward and Backward planning, Logical design of process planning systems,

Module 6

Optimal selection of manufacturing processes, tools and fixtures, coolants and other consumables required for manufacturing,

Module 7

Cost analysis and cost control for different processes, Make-or-buy decisions, Methods of process cost estimation and its application in preparation of manufacturing budget.

Text Books

1. **Process Engineering for manufacturing** by Donald F. Eary and Gerald E. Johnson
2. **Process** Planning by Peter Scallan, ELSEVIER
2. **Process Engineering techniques Evaluation** by W.F. Waller

Reference Book

1. **Product Planning systems** L.N.Goslin

PE7005 COMPETITIVE MANUFACTURING STRATEGIES (3 Credits)

Module 1

The competitive environment in the market, The WTO agreement and its effect on Indian Industries, Manufacturing as a competitive strategy, Competitive Advantages and Disadvantages

Module 2

Product Variety, Modular Design, Design for manufacturability, Selection of manufacturing technologies, Vendor Development, Vendor rating.

Module 3

Just in time manufacturing, Kanban system, and Agile Manufacturing

Module 4

Reengineering, TQM, MRP

Module 5

ERP, and simulation as tools for competitive manufacturing, Intelligent Manufacturing

Module 6

Elementary of manufacturing systems for different manufacturing scenarios - Dedicated manufacturing system, Flexible manufacturing system (FMS), cellular manufacturing system (CMS), and Re-configurable manufacturing system (RMS); Selection of manufacturing systems.

Module 7

Concept of CIM, FOF, Network based manufacturing, and E-Manufacturing

Books Recommended:

1. Manufacturing Excellence in Global Markets W. Euershelm
2. Manufacturing Systems Design & Analysis B. Wa.
3. Computer Automation in Manufacturing T.O.Boucher
4. Intelligent Manufacturing Planning P. Gu.

PE7007 POWDER METALLURGY (3 Credits)

Module 1

Definition and scope of powder Metallurgy in Industry, Merits and demerits

Module 2

Types of Powders and their manufacturing

Module 3

Fundamental properties of powders. Mech. Pulverisation, Electrolytic process, chemical reduction, Atomization

Module 4

Process of Powder Metallurgy, Mixing, Compaction, Sintering infiltration, sieving, coining, Machining etc

Module 5

Use of metal powder performs for producing industrial products

Module 6 & 7

Industrial application of powder metallurgy

Text Books

1. **Powder Metallurgy** A.K. Sinha
2. **Powder Metallurgy** Dixon

Reference Books

1. **Source Book on Powder Metallurgy** ASM
2. **Powder Metallurgy –Practice and Application** R.L. and C.R. Shakespheare

PE7009 ADVANCED WELDING TECHNOLOGY (3 Credits)

Module 1

Solid state welding

Principle, advantages ,limitations and applications of cold welding, diffusion welding, forge welding, friction welding, explosive welding, ultrasonic welding

Module 2

Radiant Beam Welding (EBW)

Principle, advantages ,limitations and applications of electron beam welding , hard vacuum welding, soft vacuum welding, principle of key hole for EBW, advantages, disadvantages, applications
Principle, advantages, limitations and applications of laser beam welding, lasing elements, principle of key hole technique for laser welding

Module 3

Underwater Welding Processes

Introduction, principles, types and applications of under water welding processes

Module 4

Residual stress and distortion

Principle of residual stress, types of residual stress, methods of identifying residual and the stress reliving methods. Numerical problems in residual stresses
Principle of distortions, types of distortion methods of the eliminating distortion

Module 5

Weldability of specific materials

Weldability of carbon steels, high strength low alloy steels, stainless steels, high alloy steels, cast iron, aluminium, copper and titanium

Module 6

Design of weldments, preheat treat, post heat treatment

Types of welded joints, design of butt joints, lap joints, eccentrically loaded joints, welding symbols, estimation of preheat temperature and post heat temperature

Module 7

Welding applications

Application of welding in automobile industries, aerospace industries, ship building industries, boiler industries
Concept of robotized welding and welding automation

Text Books

1. **Welding Process and Technology** R.S. Parmar
2. **Welding Technology** O.P. Khanna

PE7011 ADVANCED MANUFACTURING PROCESSES (3 Credits)

Module 1

ADVANCES IN CASTING

Newer casting processes - plaster mold and ceramic mold casting – vacuum casting – Evaporative pattern casting, ceramic shell investment casting, slush casting, squeeze casting and semisolid metal forming-Rapid solidification for Amorphous alloys.

Module 2

ADVANCED WELDING

Cold welding, diffusion welding, forge welding, friction welding, explosive welding,, hard vacuum welding, soft vacuum welding, Underwater Welding Processes, Concept of robotized welding and welding automation

Module 3

ADVANCED FORMING:

HERF techniques, Super plastic forming techniques, Orbital forging, Ring Rolling, Incremental forming, Isothermal forging, Hot and cold iso-static pressing, High speed extrusion, Rubber pad forming, Water, hammer forming, Explosive forming,

Module 4

POWDER METALLURGY PROCESSES

Methods of Powder production – Blending of metal powders- Compaction of metal powders- Sintering – hot pressing –Isostatic pressing – hot and cold (HIPing and CIPing), selective laser Sintering – Other shaping processes – Metal Injection moulding, pressureless compaction, ceramic moulds – spray deposition - Finishing of sintered parts.

Module 5

MANUFACTURING PROCESSES FOR PLASTICS

Extrusion, Injection, Blow and rotational moulding of plastics-Thermoforming-Compression moulding – Transfer moulding – Foam moulding - Processing of reinforced plastics and composite – Moulding – compression, vacuum bag – contact – resin transfer – transfer / injection. Filament winding.

Module 6

MANUFACTURING PROCESSES FOR MEMS

Introduction to MEMS – semiconductors and silicon – crystal growing and wafer preparation –Films and film deposition – Oxidation- Lithography- diffusion and Ion implementation – Etching - wet etching – dry etching – wire bonding and packaging – printed circuit boards .

Module 7

Micro machining- LIGA micro fabrication process – Solid free form fabrication.

TEXT BOOKS

1. Serope Kalpakjian, Steven R. Schemid, “Manufacturing processes for Engineering Materials”, Fourth edition, Pearson Education, 2003
2. Serope Kalpakjian, “Manufacturing Engineering and Technology”, Third Edition-Addison-Wesley Publication Co., 1995.

REFERENCES

1. Brahem.T.Smith, “Advanced machining”, I.F.S., U.K.1989.

2. Amstead B.H., Ostwald Phylips and Bageman.R.L., “Manufacturing Processes” John Wileys Sons, 1987.
3. Muccic, E.A., “Plastic Processing Technology”, Materials park, OHIO, ASM Int., 1994.
4. Jaeger R.C., “Introduction to microelectronic Fabrication”, Addision-Wesley, 1988.

PE7013 HUMAN FACTORS & SAFETY ENGINEERING (3 Credits)

Module 1

Introductory concepts

History, scope and objective of ergonomics/human factors engineering and its interdisciplinary concepts, occupational factors affecting the workers

Module 2

Concept of human work

Energy and energy sources of the body, categories of work and classification of work-load, fatigue, physical working capacity and its evaluation, work-rest scheduling

Module 3

Work space and work place design

Engineering authropometry, workplace design problems and general principles of work-station design, methods of workspace design, clearance, access and safety distances

Module 4

Man-Machine Systems

Choice of control and display types, design, location and layout of controls and displays, control-display compatibility and control-display (C/D) ratio

Module 5

Environmental design

Vibration, noise, temperature and light and their effect on health, safety comfort and performance

Module 6 &7

Occupational health and safety

Postural, habitual and occupational health problems and their solutions, Human error, accident and safety, management of hazard, perception, sources, evaluation and control of hazards

Text Books:

1. **Human Factors in engineering and Design** — M.S. Sandes & E. J. McCormick
2. **Occupational Ergonomics** — F. Tayyari

Reference Book

1. **Ergonomics** — K.F.H. Murrell

PE7015 VALUE ENGINEERING (3 Credits)

Module 1

Concept and evolution of VE, value cost and quality, types of values, value ratio, value assessment, value engineering, value analysis and cost reduction, unnecessary costs and its reasons and elimination, Product life cycle.

Module 2

Analysis of needs and generation of Ideas, need analysis, need and customer satisfaction, ideas and ideonomies. Creative thinking and brain storming, requirements and phases of creativity.

Module 3

Design requirements and design process, Task analysis, Principles of modern design, concept of concurrent engineering, preparation of specifications, Design for manufacturability.

Module 4

Methodologies and techniques of VE/VA, phases of VA/VE programmes, Function cost worth analysis, FAST, factor comparison method, decision and confidence level matrix, DARSIRI method. .

Module 5

Value engineering and decision making, acceptance problems and its social influences, effectiveness of VE.

Module 6

Build up of product cost, cost reduction and cost control, Value engineering and standardization.

Module 7

Applications and case studies in industrial and Business operations – engineering, design, and materials Management.

TEXT BOOKS:

1. Value Engineering – S.S. Iyer
2. Value Engineering and value Analysis by L. D. Miles.
3. Economic Product Design – Herm Buck & Butler,.

PE7017 PROCESSING OF POLYMERS & COMPOSITES (3 Credits)

Module 1

Classification, structures and properties of polymers

Module 2

Formulation of plastic products: additives and compounding, testing of plastics

Module 3

Processing of plastics: molding (compression, transfer, injection, blow) extrusion (pipe, sheet, film),

Module 4

Thermoforming, calendaring, casting, surface coating, tube forming, foaming, machining and joining of plastics

Module 5

Drilling, cutting, polishing, welding,

Module 6

Adhesive bonding, mechanical fastening etc.

Module 7

Fabrication of composite materials, processing of composite materials

Text Books:

1. **Textbook of Polymer Science** — F.W. Billmeyer Interscience Publishers A Division of John Wiley & Sons .3rd Edn. 1984
2. **Principles of Polymer Processing** — Jadmor Z and Gogos ,C.G. Wiley Interscience ,John Wiley & sons N. Y. ,1982

PE7019 ADVANCED OPERATIONS RESEARCH (3 Credits)

Module 1

Revised simplex method, sensitivity analysis, decision theory: steps in decisions theory approach, types of decision-making environments

Module 2

Decision making under uncertainty, theory of games: two – person zero sum games, pure and mixed strategies, rules of dominance, solution methods without saddle point

Module 3

Replacement and maintenance models, failure mechanism of items, replacement of items deteriorating with time

Module 4

Queuing theory: essential features of queuing systems, operating characteristics of queuing system, classification of Q-models. (M/M/I) (∞/FCFS/M/M/1: ∞ /SIRO, M/M/1: N/FCFS, M/M/S: N/FCFS).

Module 5

Dynamic Programming: characteristics of D.P. dynamic programming under certainty, calculus and tabular method of solution.

Module 6

Simulation: introduction, stochastic simulation and random numbers, simulation of inventory & queuing and PERT problems.

Module 7

Non-Linear programming methods: general N.L.P.P. graphical solution, quadratic programming-Beales method.

Text Books

1. **Operations Research** Gupta & Hira
2. **Operations Research** Kanti Swroop & Manmohan Gupta

Reference Book

1. **Operations Research** H.A. Taha

PE7021 MAINTENANCE ENGINEERING (3 Credits)

Module 1

Definition, Importance, Purpose and results of maintainability efforts, maintainability in product life cycle, maintainability tools; failure mode, effect and critical analysis, fault tree analysis, cause and effect diagram, total quality management,

Module 2

Reliability, maintainability, both-tub curve, concept of repair ability

Module 3

Principle, relative advantage, limitation and application of various maintenance strategies like, preventive maintenance, predictive maintenance, Reliability based maintenance, computer integrated maintenance etc

Module 4

Concept and strategies for tero-technology, and condition based maintenance

Module 5

Maintainability testing, costing, budgeting and control index for maintained system

Module 6

Industrial safety-concept and relevance, occupational diseases, electrical and mechanical hazards, personal protective equipment and clothing

Module 7

Safety responsibility and function of various functionaries and departments, safety & profitably employee training and safety

Text Books

1. **Engineering Maintainability** B.S. Dhillon, Eastern Economy Edition PHI
2. **Reliability Engineering and Technology** A.K. Gupta, Macmillan India Limited
3. **Industrial Maintenance Management** S.K. Srivastav, S. Chand & Company
4. **Effective Maintenance Management** E.T. Newbrough, Mc Graw Hill
5. **Industrial Safety Management** N.K. Tarafadar, K. J. Tarfdar, Dhanpat Rai

PE7023 ECO -FRIENDLY MANUFACTURING (3 Credits)

Module 1

INTRODUCTION; introduction to lean, sustainable, green manufacturing; concept of Eco friendly manufacturing; the 18 monozukuri principles.

Module 2

REGULATORY CONSIDERATIONS: Regulatory considerations and sustainability strategies, Imperative global warming perspectives, Carbon credits, green power and renewable energy credits;

Module 3

ENVIRONMENTAL PERFORMANCE INDICES; Effect of industrial activity on environment, measures and metrics; ranking of risks; Environmental Load Units (ELU); International green manufacturing standards and compliance; ISO 14000;

Module 4

MATERIAL FLOWS THROUGH THE ECONOMY AND THE ENVIRONMENT: Metals production**,** Metal recycling, Energy and other advantages of metal recycling,

Module 5

INDUSTRIAL WASTE: Type of wastes, causes of waste generation and its elimination in manufacturing industries, Hidden waste in industries, workplace organization.

Module 6

ANALYTICAL TOOLS: Lean vision and lean principles, value added and non-value added activities Metrics for sustainable practices; life cycle assessment/impact tools; Product Stewardship in Industry

Module 7

ECO FRIENDLY MANUFACTURING SYSTEM: Green Design and Manufacturing in Consumer Products; Green rapid prototyping and rapid manufacturing; green packaging; Green collaboration processes via the Internet; Reverse supply chain, green supply chain.

Text Books

1. **Fast Track to Waste Free Manufacturing** J.W. Davis, Productivity Press USA
2. **Clean Production**, K.B. Misra, Springer – Verlog – 1996

Reference Books:

1. **Environmentally Benign Manufacturing,** WTEC Panel Report, 2001
2. **Design for environment: A guide to sustainable product development: Eco- efficient product development**, J, Fiksel. McGraw-Hill.- 2009
3. **Green Manufacturing: Case Studies in Lean Manufacturing and Sustainability**. , **AME,** Association for Manufacturing Excellence (2007) Productivity Press, Inc.

Breadth Subject offered by department

PE5009 INDUSTRIAL ORGANISATION AND MANAGEMENT (3 Credits)

Module 1

Business organization

Legal forms of business organization-single ownership, partnership and joint stock company and their formation

Share & their classes, rights and privileges, borrowing of capital through mortgages, debentures, unsecured notes and bonds, ownership and operation of a joint stock company through board of directors

Module 2

Principles of Management

Elements of managerial functions-planning organizing, staffing, direction and control, authority and responsibility, leadership and principles of co-ordination, uses of committee as a management tool, span of control

Module 3

Organization Structure

Line, line and staff, Functional, Lateral (Fayol's Bridge) and Metric organization structures, organization chart and organization manual

Module 4

Budget and Budgetary control

Functions, types and preparation of budgets, working of budgetary control

Module 5

Marketing Management

Functions of sales and marketing, channels of distribution, Sales promotion, advertising and publicity, product packaging and product printing

Module 6

Human Resource Development

Main functions of personnel department, morale, motivation and behavior, handling of Industrial grievances through joint consultation and collective bargaining, workers participation in management.

Module 7

Industrial legislations

Factories act, trade unions, trade dispute act, workmen's compensation act, payment of wages act.

Text Books

1. **Industrial Organization and Management** Riggs, et al.
2. **Industrial Engineering and Management** O P Khanna

References

1. **Principles of Management** Koonze o'Donell

PRESENT SYLLBUS

PE 5011 PROJECT ENGINEERING (3 Credits)

Module 1 The scope of project, Characteristics of a project, Stages of a project, Project constraints, Project Management Structures.

Module 2 Responsibilities of project manager, Project Productivity, The anatomy of a project.

Module 3 Environmental considerations in project evaluation, Main issues and secondary issues in Feasibility study, Social cost benefit analysis, Commissioning, Evaluation of competing projects.

Module 4 Budgetary aspects and considerations of a project, Industrial/Engineering projects (Mining, Drilling, Refinery etc.), R & D projects, Turnkey projects.

Module 5 Networking Modeling of a project, Deterministic & Probabilistic activity network, Line of balance, Time- Cost Trade-off in a project, Mega projects.

Module 6 Project Scheduling Techniques, PERT, CPM Models.

Module 7 Project Monitoring Techniques, Performance and cost evaluation (PACE), Project Staffing Requirements, Resource Leveling, Project Documentation, Computer application in Project Engineering.

Text Books:

1. Project Management by Prasanna and Chandra, Tata McGraw Hill.
2. Elements of Project Management by Pete Spinner, Prentice Hall, USA.

Reference Books:

1. Production and Operation Management by Alan Muhlemann, John Oakland and Keith Lockyer, MacMillan India Ltd.
2. A course in PERT and CPM by R. C. Gupta, Dhanpat Rai Publications(P) Ltd, Delhi.
3. Industrial Engineering and Management by O. P. Khanna, Dhanpat Rai & Sons.
4. Production and Operation Management by S. N. Chary, Tata McGraw Hill.

PE 6009 ENGINEERING ECONOMY (3Credits)

Module 1

Accounting of Business Transactions

Accounting principles, journal and ledger entries, balance sheet, profit and loss statement, ratio analysis

Module 2

Cost and Cost Analysis

Cost structure, methods of allocating overhead costs, standard cost, concept of opportunity cost, sunk cost, fixed cost and variable cost

Module 3

Break Even Analysis

Drawing of brake even charts, effect of different variable on breakeven point, cost comparison of two or three alternatives

Module 4

Time Value of Money

Single sum and series of cash flow, uniform and gradient series, multiple compounding periods in a year, continuous compounding, bonds

Module 5

Comparison of Alternative Proposals

Bases of comparison- present worth amount, annual equivalent amount, future worth amount, rate return, defining mutually exclusive alternatives, decision criteria for selection of investment proposals, comparison of alternatives, with unequal service life, sensitivity analysis

Module 6

Replacement Analysis

Reasons for replacement, evaluation of replacement involving excessive maintenance cost, decline in efficiency inadequacy and obsolescence

Module 7

Depreciation and Decision Making Under Uncertainty

Methods of depreciation and their comparison, decision making on the basis of expected value decision tree in the evaluation of alternatives

Text Books:

1. **Modern Accountancy** I.M. Pandey
2. **Engineering Economy** E.P.Degarmo