

Third Year

FALL SEMESTER

IM-303 Production Management

Production Management & Systems:

Introduction to production Management; System concept; Functions of management; Managerial decision making; Models as decision aids

Plant Location & Plant Layout:

Selection of region; Selection of community; Site selection; Location factor dependence; Sources of assistance; Plant location trends; Quantitative analysis; Plant layout; Product & process layout analysis and comparison; Material handling considerations in layout.

Production Planning & Control:

Formalized production planning; Production planning methods; Master scheduling; MRP; MRP inputs, MRP outputs; Product structures; Types of MRP; Capacity planning and control; Production control systems; Job shop scheduling; Production control charts; Scheduling techniques; Purchasing and procurement.

Planning & control Techniques:

Inventory control; types of inventory; Inventory costs; Independent versus dependent demand; EOQ/EPQ models; Types of control systems; Selective inventory control; Inventory system development; Project planning; CPM/PERT; Network development; Determination of activity times; Establishment of critical path; Probabilistic statements.

Cost Estimating:

Element of cost; Material cost, direct and indirect labor cost and Overhead cost structure; Prime cost, Factory cost, Manufacturing cost, Total cost, Selling price; Estimation of cost elements; Methods of estimation; Economics of tooling.

Maintenance:

Types of maintenance; Breakdown maintenance; Preventive maintenance; Individual versus group replacement; Internal versus external maintenance

IM-310 Tool Design

Jigs and Fixtures:

Basic Design principles and Classification Materials for jig and fixture development Lathe, Milling and broaching fixtures Detailed discussion of jigs for drilling and drilling related operations Consideration for mounting jigs and fixtures on machine tools *Inspection Jigs and Fixtures* Analysis of operation with design example

Locating and Clamping Methods:

Principles of Location Pins, plugs, dowels and nests Conical Locating, adjustable locators. Clamping principles, design of various clamps with typical applications. Pneumatic and Hydraulic clamping.

Design of Cutting Tools:

Design of tools for cutting operations Single point tools for lathe and boring operations. Multiple point tools for milling and drilling operations.

Design of Dies and Moulds:

Terminology of Press-Working operations Mechanical, Hydraulic and Pneumatic presses Materials for press tools Design of Piercing, Blanking and Shearing dies. Design of Bending, Forming and Drawing dies. *Design of Moulds for plastic and Rubber Parts* Pressure, Die Casting, Injection and Blow moulding

IM-312 Applied Thermo Fluids

Refrigeration cycles:

Reversed Carnot cycle, Vapor-compression cycle, Vapor absorption cycle, Comparison of Vapor compression cycle with reversed Carnot cycle, Multi pressure systems

Application of refrigeration:

Domestic refrigerator, Water cooler, Cold storage, Ice making plant, Dairy industries application, Heat pump.

General theory of two and three dimensional flow:

Fluid element kinematics, Irrotational flow, Relation between Irrotational flow and viscosity, Circulation, Potential flow, Stream and velocity potential functions, Uniform flow, Source and sink flow, Vortex, Doublet, Lift and drag forces, Differential analysis of fluid flow: Continuity and momentum equation.

Boundary layer theory:

Laminar boundary layer, turbulent boundary layer, Boundary layer control, Airfoil cascades

Computational fluids dynamics:

Introduction, Numerical operations for differentiation and integration, governing equations of CFD, Programming procedure, Simple exercise problem,

Thermo fluid applications in manufacturing processes:

Heat transfer in metal machining, Heat transfer in metal forming, Heat transfer in alloy solidification, Binary phase diagrams and kinetics of phase transformation.

HS-304 Business Communication & Ethics

Business English:

Writing formal and business letters and memos: Drafting notices and minutes; Theoretical knowledge and comprehension of contracts and agreements; Preparing proposals and conducting and writing research project reports. Participating in seminars and interviews, and writing and presenting conference papers; Solving IELTS type papers.

Engineering Ethics:

Definition of code of ethics: Review of code of ethics of national and international engineering bodies. Relationship between ethics and human rights and their importance in human settlements and societies

MT-333 Advanced Calculus & Fourier Analysis

Partial Differential Equation:

Basic concepts and formation of partial differential equations; Linear homogeneous partial differential equations and relations to ordinary differential equations; Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations; Lagrange's solution; Various standard forms.

Fourier series:

Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients; Expansion of function with arbitrary periods Odd and even functions and their Fourier series; Half range expansions of Fourier series, "DFT and FFT, Fourier Spectrum".

Advance calculus:

Define a stationary point of a function of several variables, define local maximum, and saddle point for a function of two variables the stationary points of a several variables, obtain higher partial derivatives of simple functions of two or more variables, iterated integrals, double and triple integrations with applications (area, centroid, moment of inertia, surface area, and volume, use multiple integrals in solutions of engineering problems.

Vector Calculus:

Vector differential operator, directional derivative, gradient, divergence, curl of a vector field, and laplacian operators with applications (Solenoid, conservative, etc)

Vector Integrations; Evaluate line integrals along simple paths, apply line integrals to calculate work done, apply Green's theorem in the plane to simple examples, evaluate surface integrals over simple surface, use the jacobian to transform a problem a new co-ordinate system, apply Gauss' divergence theorem to simple problems, apply Stokes' theorem to simple examples.

SPRING SEMESTER

IM-308 Operations Research

Linear Programming:

Historical development of Operations Research, Formulation of Model, Linear programming: Graphical Analysis and Solution, Simplex Method of Solution, Equality constraints, Inequality constraints, Big M method, Duality theory, Primal and Dual problems, & Sensitivity Analysis.

Special Types of LP Problems:

The transportation problem, North-west corner rule, Vogel's approximation method, Russell's method, Transshipment problem, Assignment problem

Queuing Theory:

Basic Queuing process, Assumptions for analysis, Queuing discipline and characteristics, Service mechanism, The birth and death process, Steady-state measures of performance, Single-server models, Multiple-server models, Machine servicing model.

Dynamic programming:

Recursive nature of computations in DP, Forward and backward recursion, Selected DP applications

Simulation:

Introduction to simulation and its application in manufacturing

IM-307 Advance Manufacturing Processes

Mechanics of Orthogonal Metal Cutting:

Chip formation; Thin-zone models for analysis; Shear angle relationships; Role of friction in metal cutting; Prediction of forces; Velocity relationships; Force and stress relationships.

Tool Life & Tool Wear:

Forms of wear in metal cutting, Tool life criteria, Variables affecting tool life, Taylor's tool life equation, Generalized tool life equation, Methods of tool life testing data. Economics of Metal Cutting: Application of minimum cost per piece, maximum production rate, and maximum profit rate criteria in turning operations.

Metal Forming:

Stress: stress tensor, equilibrium equations, stress transformation equations, plane stress, Mohr's circle for stress transformation. Strain: plane strain, strain tensor, strain transformation equations, isotropic elasticity, strain energy. Bulk forming, sheet forming, Yield criteria, Plastic work, Plastic instability, Effective stress, Effective strain, Flow rules for plastic stress-strain relations.

Work Hardening:

Tensile test, Mechanical properties, Nominal & true stress-strain curves, Work hardening expression, Behavior after necking, Direct compression, Bulge test, Plane-strain compression test.

Bulk Forming Analysis:

Ideal work method, efficiency factors, extrusion and rod drawing, force balance or slab analysis, deformation zone geometry, sheet drawing, flat rolling, direct compression in plane strain, sheet bending, formability.

Hot & Cold Working of Metals:

Advantages and limitations of Hot working and Cold working processes; Methods of Forging; Hammer forging; Die forging; Drop, Press and Upset forging; Construction of drop forging hammers; Forging defects and their causes.

IM-320: Modeling & Simulation

Introduction:

Modeling & Simulation Need and Significance of Simulation, Computer Simulation, Randomness in Simulation, Types of Simulation, Simulation Process.

Spreadsheet Simulation:

Simulation in a Spreadsheet Environment, Useful Spreadsheet Functions, Numerical Examples of Spreadsheet Simulation.

Simulation Using Software:

The Software Environment, Simple Monte-Carlo Simulation. Modeling Simple Discrete Event Dynamic System (DEDS): Drive-Through Pharmacy, Implementation of Model in Software Environment, Introduction to Arrival Process, Resources, Processes, Defining Run Parameters, Analysing results.

Modeling Queuing and Inventory System:

Introduction, Single Line Queuing System, Simulating Single Queues in the Software, Networks of Queuing Station – Station, Route and Sequence Modules in the Software, Modelling and (Q,R) Inventory Control Policy.

IM-408 Automation & Robotics

Production Operations & Automation Strategies:

Automation defined; Types of automation; Reasons for automation; Arguments for & against automation.

Manufacturing industries; Types of production; Functions in manufacturing; Organization & information processing in manufacturing; Plant layout; Production concepts & mathematical models; *CIM, FMS/FMC*, Automation strategies

Automotive Type Automation

Automated flow lines; Methods of work-part transport; Transfer mechanism; Buffer storage; Control functions; Automation for machining operations; Design & fabrication considerations.

Analysis of Automated Flow Lines & Line Balancing:

General terminology & analysis, Analysis of transfer lines without storage, Partial automation. The assembly process, Assembly systems, Manual assembly lines, The line balancing problem; Methods of line balancing: Largest candidate rule, Kilbridge & Wester's method, Ranked positional weights method.

Automatic Control Systems and Components:

Basic elements of automatic control system, Levels of automation, Analysis of regulated and servo control systems, Sensors, Actuators, Data conversion, Mechanical components of automation.

Robotics Technology & Applications

Robot anatomy, Robot Configurations, Accuracy & Repeatability, Robot specifications, End effectors, *Kinematics and Dynamics of a 2-link Manipulator*, Characteristics of Robot applications, Robot cell design, Types of Robot applications.

IM-411 Methods Engineering

Work Study:

Introduction to work study, Techniques of work study and their relationship, Basic procedure of work study

Method Study:

Definition; Objectives; Procedure; Process chart symbols; Outline process chart; Flow process charts; Multiple activity chart; Two handed chart; Critical Examination; Case studies & Application.

Methods and movements at the workplace:

General considerations, The principles of motion economy, Classification of movements, Re-organization of a workplace by means of a two-handed process chart, Micro-motion study, Simo chart, Use of films in methods analysis, The development of improved methods.

Work Measurement:

Definition; Objectives; Techniques of work measurement; Stop watch time study; Timing methods; Performance rating; Standard timing; Allowance factors. Work sampling; Confidence level; Determination of sample size; Making random observations; Scope of work sampling. Predetermined time standards; Definition; Advantages and criticisms; Motion classification; TMU; Use of PTS systems.

Ergonomics:

Human and working environment Interaction, lighting, illumination design, noise and vibration, temperature, dust, humidity, comfort level. Machine controls and displays of dials, Scope of Ergonomics and its practice in Pakistan.

