

Second Year

FALL SEMESTER

IM-203 Manufacturing Processes

Sand Casting:

Introduction; Sand casting procedures; Patter making; Material types and construction of patterns; Pattern allowances; Moulding process; Moulding materials; Tools and equipment; Testing of sand; Moulding machines; Core making; Types of cores; Core making machines; Shell moulding; Plaster moulding; Centrifugal casting; Trimming and finishing of castings; Seasoning of castings; Inspection of castings.

Die Casting:

Pressure die casting; Vacuum die casting; Gravity die casting; Die casting machines; Hot chamber and Cold Chamber methods; Die casting alloys; Die design, construction, and material; Die casting.

Welding Processes:

Classification of welding processes; Oxyacetylene welding, oxygen torch cutting, and flame straightening; Arc welding; Shielded arc welding, Gas tungsten arc welding, Gas metal arc welding, Flux-cored arc welding, submerged arc welding, plasma arc welding, stud welding, spot welding, Seam welding, Projection welding; Other welding processes: Forge welding, Roll welding, Friction welding, explosion welding, Thermit welding, Electron beam welding, Laser welding and cutting; Brazing and Soldering.

Fabrication of Plastics:

Casting; Blow moulding; Compression moulding; Transfer moulding; Cold moulding; Injection moulding; Reaction injection moulding; Vacuum forming; Welding of plastics

Machining Processes and Machine Tools:

Machine tools using single point tools: Description, functions and operation performed on lathe, shaper, Planner, and boring machines; work holding devices.

Machine tools using multiple cutting edge tools: Description, functions, and operations performed on drilling, milling, gear cutting, and broaching machines.

Machine tools using abrasive wheels; description and functions of various types of grinding machines; wheel dressing, and wheel balancing; Honing, lapping, and super finishing operations; thread manufacturing.

Non-traditional machining processes such as EDM, ECM, & ultrasonic machining.

Machining parameters:

Determination of machining time and material removal rate for various machining operations Cutting tools for manufacturing: Cutting tool material characteristics; Cutting tool materials, tool steels, HSS, Cubic Boron Nitrides; Tool Geometry, Tool life, Tool wear, and machinability; Taylor's Tool life model, sharpening and Reconditioning of cutting tools; Basic concept and design of jigs and fixtures.

IM-209 Mechanics of Materials

Stress-Strain Relations

Stress, Deformation, strain, elastic, stress strain behavior of materials, Poisson's ratio, General stress method, Thermal stress and strain Statically indeterminate System Volume changes, constrained materials, Beams and frames (double integration method, superposition method, Virtual work).

Bending Stresses

Simple bending theory, shear stresses in bending, bending slope and deflection, asymmetrical bending, bending of initially curved bars.

Theory of Torsion

Torsion of thin walled cylinder, Torsion of a solid circular shaft, Hollow shaft, Torsion of rectangular and noncircular sections, Helical springs.

Theory of Columns and Pressure

Vessels Long columns, struts, columns with initial curvature, Stresses and strains in pressure vessels

IM-208 Materials Engineering

Introduction to Materials Engineering:

Types of materials, sources of materials, material science and engineering crystalline & amorphous materials, application of materials

Metallic Materials:

Pure metals and alloys, nature and properties of metals and alloys, major properties of metallic materials (chemical, physical, mechanical), single crystal and poly-crystalline metals, crystal defects and the mechanisms of deformation and fracture, plastic flow in poly-crystalline materials, structure- property, relationships, macro & micro examinations, structural aspects of solidification & solid phase transformations in binary systems, ferrous and non-ferrous metals, various heat treatments, TTT-diagram.

Ceramics, Glasses, Rubbers & Refractory Materials:

Compositions, properties, structures of various non-metallic materials, application of ceramics, glasses, rubber & refractory materials, methods of manufacture.

Polymers:

Polymerization, Structural feature of Polymers, Thermoplastic Polymers, Thermo-setting Polymers, Additives, major mechanical properties

Composites:

Introduction to composite materials; types of composite materials, method of fabrication of composite materials, property averaging, major mechanical properties

Environmental Degradation:

Metal degradation by atmospheric, aqueous & galvanic corrosion; stress corrosion cracking methods of corrosion prevention, behaviors of metal at elevated temperature – pyrometers oxidation, scaling and creep. Chemical degradation of ceramics & polymers, radiation damage, surface improvement against degradation

MT-252 Introduction to Probability & Statistics

Statistics:

Introduction, types of data & variables, presentation to data, tabulation, frequency distribution, graphical representation, simple & multiple bar diagrams, pie-diagram, histogram, frequency polygon, frequency curves & their types, measures of central tendency and dispersion:

statistical averages, median, mode, percentiles, quartiles, range, moments, skewness & kurtosis, quartile deviation, mean deviation, standard deviation, variance & its coefficient, practical significance in related problems.

Probability:

Basic concepts, permutation & combination, definitions of probability, laws of probability, conditional probability, Bayes' rule, related problems in practical significance,

random variables:

Introduction, discrete & continuous random variables, random sequences and transformations, probability mass function, probability density function, distribution function, mathematical expectations, Moment generating function (M.G.F.).

Probability distributions:

Introduction, discrete probability distributions, binomial, poisson, hyper geometric & negative binomial distributions, continuous probability distribution: uniform, exponential, gamma & normal distributions & their practical significance.

HS-205 Islamic Studies

Thematic Study of Holy Quran.

1. Basic Islamic Beliefs

Topics

i) Tauheed:

Al-Ambiya-22, Al-Baqarah-163-164

ii) Prophethood:

Al-Imran-79, Al-Huda-7 Al-Maidah-3

iii) Here-After:

Al-Hajj-5, Al-Baqarah-48

*Two Hadith

2. Basic Islamic Practices:

Al-Mu'minun-1-11

3. Amre-Bil-Ma'Roof Wa-Nahi Anil Munkar

The Concept of Good & Evil.

i) Importance & necessity of Da'Wat-e-Deen Al-Imran-110.

ii) Method of Da'Wat-e-Deen. An-Nehl-125, Al-Imran-104

*Two Hadith

4. Unity of the Ummah:

Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An'am-108

*Two Hadith

5. Kasb-e-Halal.

Taha-81, Al-A'raf-32-33, Al-Baqarah-188

*Two Hadith.

6. Huquq-ul-Ibad:

i) Protection of Life

Al-Maidah-32

ii) Right to Property

An-Nisa-29

iii) Right of Respect & Dignity

Al-Hujurat-11-12

iv) Freedom of Expression

Al-Baqarah-256

v) Right of Equality

Al-Hujurat-13

vi) Economic Security

Al-Ma'arij-24-25

vii) Employment Opportunity on Merit

An-Nisa-58

viii) Excessive Right to Justice

An-Nisa-135

7. Women Rights:

An-Nahl-97, Al-Ahzab-35, An-Nisa-07

8. Relations With Non-Muslims:

Al-Mumtahanah-8-9, Al-Anfal-61.

Last sermon of Hajj at Arafat Translation & the important points of the sermon.

Serat Life of the Holy Prophet:

Birth, Life at Makkah.

Declaration of Prophethood, preaching & its difficulties migration to Madina.

Brotherhood (Mawakhat) & Madina charter. The Holy War of the prophet

(Ghazwat-e-Nabawi) Hujjat-ul- Wida.

Islamic Civilization:

Impacts of Islamic civilization on the sub-continent The civilization of sub-continent before Islam The Political, Social & Moral impacts of Islamic Civilization on sub-continent. Academic, Intellectual, Social & Cultural Impacts of Islam on the World

*N .B: As prescribed by UGC. The original Text & complete course plan may be obtained from the Department of Humanities.

HS-209 Ethical Behaviour

1. Introduction to Ethics:

- i) Definition of Ethics
- ii) Definition between normative and positive science
- iii) Problem of freewill
- iv) Methods of Ethics
- v) Uses of Ethics

2. Ethical Theories:

- i) History of Ethics: Greek Ethics, Medieval, Modern Ethics
- ii) Basic Concepts of right & wrong: good & evil
- iii) Utilitarianism, hedonism, self-realization: egoism, intuitionism, rationalism
- iv) Kant's moral philosophy

3. Ethics & Religion:

- i) The relation of Ethics to religion
- ii) Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism, Christianity, Islam

4. Ethics, Society and Moral Theory:

- Society as the background of moral life
- Ethical foundation of rights of moral life
- Universalism and Altruism
- Applied Ethics
- Theories of punishment

SPRING SEMESTER

IM-211 Machine Design

Principle of Design

General procedure for design, Mechanical properties of materials, Stresses in machine elements, Stress concentration, Composite sections, Theories of failure including fatigue failure

Design of Machine elements

Shafts, Shaft materials, Shaft ' operating under combined loading, Critical speed introduction to flexible shafting, Connecting rods, Crank shafts, Bearings, Bearing materials, Design of journal and roller bearing, Theory and method of lubrication, Gyroscopes (principle, operation and applications), Balancing of reciprocating and rotating masses. Design of Drive Units and Assemblies Gear (terminologies, classification and design), Design of gear boxes/trains, Belt and chain drives,

Brief description of proposed changes

Design of chain including drag chain conveyors and belt conveyors, Brakes, Clutches Friction and mechanical type of clutches, Linkages, Carns, Joint (knuckle, cotter and universal), Couplings (universal, flanged and flexible

IM-212 Computer Aided Engineering Design

Introduction to CAD

CAD applications in Engineering, Mechanical product design, CAD, CAM and CAE integration, Components of CAD, CAM and CAE Concepts of Graphics Programming Coordinate transformations, Projections Geometric Modeling Systems Modeling Methods, Set operations Constructed solid geometry, Boundary representation Representation of Curves & Surfaces Types of representations, Analytic, manipulation of curves and surfaces

CAD/CAM Data Exchange

Data types and exchange methods, Neutral data exchange format: IGES, STEP Reverse Engg. & Rapid Prototyping/Manufacturing 3D scanning and its types, Surface fitting on cloud data rapid prototyping and manufacturing.

MT-225 Linear Algebra & Ordinary Differential Equations (C)

Linear Algebra:

Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal tri-diagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transition matrix, basic concept of tensors, eigen value and eigen vectors of a matrix, Diagonalization, Cayley-Hamilton theorem. Applications of linear algebra in Engineering

Euclidean Spaces and Transformation:

Geometric representation of vector, norm of vector, Euclidean inner product, projections and orthogonal projections, Euclidean n spaces n properties Cauchy-Schwarz inequality, Euclidean transformations, apply geometric transformations to plane figure, composition of transformations.

1st Order Differential Equations:

Basic concept; Formation of differential equations and solution of differential equations by direct integration and by separating the variables; Homogeneous equations and equations reducible to homogeneous form; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories; Application in relevant Engineering.

2nd and Higher Orders Equations:

Special types of n^{th} order differential equations with constant coefficients and their solutions; The operator D ; Inverse operator $1/D$; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

Laplace Integral & Transformation:

Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the n^{th} order derivative, initial and final value theorem Laplace transform of integrals, Laplace transform of functions $t^n F(t)$ and $F(t)/t$, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential using Laplace transform.

MF-303 Applied Economics for Engineers

Introduction

Engineering economy defined; Measures of financial effectiveness; Non-monetary factors and multiple objectives; principles of engineering economy

The Economic Environment

Consumer and producer goods; Measures of economic worth; Price, Supply, & Demand relationship; Production; Factors of production; Laws of return.

Cost Concepts & Analysis

Sunk & opportunity costs; Fixed, variable, and incremental costs; Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Breakeven analysis; Unit cost of production; Cost-benefit analysis; Feasibility studies; Value analysis in designing & purchasing.

Time Value of Money

Simple interest, Compound Interest, Cash flow diagrams, Interest formulas, Nominal versus effective interest rates, continuous compounding

Depreciation and Depletion

Purpose of depreciation, types of depreciation, economic life, what can be depreciated

Comparing Alternatives

Present economy, Selection among machines, materials, processes, and designs, Payback period method, Present worth method, Uniform annual cost method, Rate of return method, Alternatives having identical lives, Alternatives having different lives

Production Concepts & Mathematical Models

Manufacturing lead time; Production rate; Capacity; Utilization; Availability; Work in process; WIP and TIP ratios.

Linear Programming

Mathematical statement of linear programming problems; Graphic solution; Simplex method; Duality problems

Capital Financing and Budgeting

Types of ownership; types of stock; Partnership & joint stock companies; Banking & specialized credit institutions.

Industrial Relations

Labour problems; Labour organizations; Prevention & settlement of disputes.

IM-213 Metrology and Quality Control

Introduction:

History and Philosophy of metrology, Metrology and the need for Reliable Measurement
metrology Classifications

Standardization: Standardization Organizations and their Standards related to metrology,
International

Classification for metrology Standards, Interchangeability, and Measurements:

Common Gauges & Measurement Instruments Special Gauges and application, Gauge Selection
and handling and use, Surface Plate Tools and Techniques, Specialized Inspection Equipment
Calibration Surface texture Measurement System analysis: Process Variability). Variability in
Measurement Process, Evaluating

Measurement System Performance Inspection Planning & Processes, Testing methods

QUALITY CONTROL:

Introduction: Statistical Methods in metrology, Defining Quality & its Philosophies, defining
SPC/SQC and its tools/Techniques.

Quality Control Tools:

Flow Chart, Check Sheet, Histogram, Pareto Chart, Scatter Diagram, Cause and Effect Diagram,
Variable & Attribute Control Charts

Acceptance Sampling:

OC Curve. Consumer & Producer Risks, AQL & LTPD, Sampling Errors, Acceptance Sampling
for Continuous Production, Acceptance by Variables, Single, Double, & Sequential Sampling.

Process Capability:

Cp/ Cpk

Reliability: Introduction, Life History Curve, Taguchi

Loss Function

