



DEPARTMENT OF
MECHANICAL ENGINEERING TECHNOLOGY

COURSES OUTLINE

ISLAMIC STUDIES (MH-112)

Course Outline

Introduction to Quranic Studies

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

Study of Selected Text of Holy Quran

- 1) Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)

Study of Selected Text of Holy Quran

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14)

Seerat of Holy Prophet (S.A.W)

- 1) Life of Muhammad Bin Abdullah (Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W) II

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction to Sunnah

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

Introduction To Islamic Law & Jurisprudence

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

Islamic Culture & Civilization

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

Islam & Science

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

Islamic Economic System

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

Political System of Islam

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

Islamic History

- 1) Period of Khlaft-E-Rashida
- 2) Period of Ummayyads
- 3) Period of Abbasids

Social System of Islam

- 1) Basic Concepts of Social System of Islam, Elements of Family
- 2) Social System of Islam
- 3) Ethical Values of Islam

Applied Physics (MS-113)

Course Outline

PHYSICS OF ATOMIC STRUCTURE AND ELECTRICITY

Basics of Mechanics, Moment of inertia, simple harmonics motion. -Atomic structure. Atomic bonding. Electromotive force and potential difference, Current. Effects of electric current. Conductor. Insulator. Semiconductor. Electrical quantities. Resistance. Alternating Current.

ELECTROSTATICS AND CAPACITANCE

Coulomb's law. Electric charge. Electric field. Electric field strength and Electric Flux. Gauss's law. Electric potential. Dielectric. Capacitance, Charging and Discharging of Capacitor. Capacitors in series and in parallel. Energy in capacitor.

ELECTROMAGNETISM

Magnetic fields. Characteristic of lines of magnetic flux. Magnetic fields due to currents. Electromagnet.

Force on current carrying conductor in magnetic field. Electromagnetic induction. Magneto motive force. Permeability. Reluctance, Self-inductance. Inductance of a coil, Air core and Iron cored inductor.

Energy stored in inductance, Mutual inductance. Electromagnetic oscillations.

SEMICONDUCTOR PHYSICS

Energy levels in a semiconductor, Hole concept. Intrinsic and Extrinsic regions. PN junction. Doppler Effect

Applied Mathematics-I (MS-123)

Course Outline

Complex numbers, Argand diagram, De Moivre's theorem, hyperbolic and inverse hyperbolic functions. Algebra of vectors and matrices, systems of linear equations. Derivative as slope, as rate of change (graphical representation). Extreme values, tangents and normals, curvature and radius of curvature. Differentiation as approximation. Partial derivatives and their application to extreme values and approximation. Integration by substitution and by parts, integration and definite integration as area under curve (graphical representation).

Reduction formulae. Double integration and its applications. Polar and Cartesian coordinates, polar curves, radius of curvature, cycloid, hypocycloid, epicycloids and involutes of a circle.

Applied Chemistry (MS-133)

Course Outline

- Introduction, History, Branches of Chemistry, Applications.
- Chemical kinetics and catalysis: Introduction to rate equation and reaction order, reaction mechanism, relation between rate equation and Reaction mechanism, First order & Second order.
- Dependence of temperature on reaction rates. Arrhenius theory, collision theory, Transition state theory, Physical adsorption, chemisorption, Freundlich's expression, Langmuir adsorption isotherm, Heterogeneous catalysis, examples of heterogeneously catalyzed reactions.
- Features of Coordination Chemistry & Organic Reaction Mechanism: Coordination chemistry, coordination number, chelate effect, coordination complexes and their applications
- Features of Coordination Chemistry & Organic Reaction Mechanism: Electrophilic substitution reactions in aromatic systems. Some Name reactions viz. Hoffman's rearrangement, Beckman's reaction, Riemer-Tiemann
- Thermodynamics and electrochemical Phenomenon: Heat, work and energy, reversible and irreversible processes, work done in an isothermal reversible expansion of ideal gas.
- Enthalpy, Entropy, Electrochemical and galvanic series, polarization, decomposition potential, over voltage.
- Forced harmonic excitation of single degree of freedom systems: Base excitation
- Theories of corrosion. Differential aeration theory. Factors influencing corrosion. Types of corrosion
- Control of corrosion: Design and material selection, anodic and cathodic protection, protective coatings, corrosion inhibitors. Fuel Cells.
- Analytical aspects of water: Sources, conservation of water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water.
- Chemistry involved in sedimentation, coagulation and sterilization. Softening of water, lime-soda, ion-exchange process and numerical problem. Boiler troubles, causes and effects, methods of prevention.
- Engineering Materials: Glass, ceramics, refractory, composites, magnetic materials, Polymers & structure property relationship.
- Thermoplastic & thermosetting plastics. Preparation, properties & applications of some commodity and engineering polymers. Conducting polymers.

- Interaction of radiation with matter: Molecular spectroscopy, vibrational, rotational, absorption, emission and light scattering phenomenon.

Introduction to Computer Fundamentals (MS-143)

Course Outline

- Basic terminology: computer, user, hardware, software, chip, program
- Input: data, instructions (programs, commands, user responses), Output: text, graphics, and video, audio
- Types of computers: personal, notebook, handheld, PDA, internet appliance, server, mainframe, supercomputer
- Programming languages, Machine, assembly, High-level
- Key terms: VLSI, microprocessor, microcomputer,
- Computer Software: Terms: file, menu, font, voice recognition, FAQ, online help, wizard, software suite, single-user license, site license, application window, dialog box, clip art, cross-platform application
- Word processing
- Spreadsheet: cell, function, recalculation, charting, Database: record, field, query
- Accounting software, Computer Aided Design (CAD), desktop publishing, paint/image, multimedia, web authoring, System software
- Operating System (OS), booting (startup), Cold vs. warm, BIOS, Steps in booting, Utility programs: file viewer, file compression, backup, screen saver, disk scanner, disk defragmenter
- Computer hardware, System unit Terms: motherboard, chip, memory, storage, expansion slot (plug and play), port (serial vs parallel), bus (expansion bus), power supply, Central Processing Unit (CPU), Machine cycle (fetch, decode, execute, store), Memory, Volatile vs. nonvolatile, RAM vs ROM, Cache, Hard disk, Tracks, sectors, platters, RAID (mirroring and striping)
- Internet hard drive, Compact disks (and drives), PC Cards, Miniature mobile storage (Compact Flash, Memory Stick, Microdrive, Smart Media), Input Devices: Keyboard, Pointing Devices, Others: trackball, touchpad, pointing stick, light pen, touch screen, stylus
- Handwriting recognition software, Sound, Image: Digital camera, Scanners (flatbed, optical readers), Optical readers, Optical character recognition (OCR), bar code scanner, Optical Mark Recognition (OMR),
- Video: Web cam, PC Video camera, Output Devices, Display device, CRT monitor, Liquid Crystal Display (LCD) – passive versus active
- matrix, Gas plasma monitor
- Printer and its types: Impact printers, Dot-matrix printer, Line printer, Plotter, Non-impact printers, Ink-jet, Laser, data projector

- Fax machine (fax modem), Internet, E-commerce, Ethics and social issues, Privacy and security

Workshop Technology (MT-113)

Course Outline

- Workshop Safety precaution for each workshops.
- Introduction to Machining theory & practice.
- Mechanism of chip formation, Types of Chips, builds up edges, characteristics of BUE.
- Accessories index milling.
- Tool life, tool material, cutting force, cutting fluids, machineable materials.
- Capabilities, Capacities, programming & Tools.
- Lath and milling operations, taper turning, drilling, threading, reaming, knurling, boring, chamfering.
- Cutting parameters for lath, cutting speed, feed, and depth of cut.
- Gear cutting methods, gears milling, gear forming, broaching, Hobbing, gear grinding, gear finishing
- High speed and special purpose machining
- Grinding operations, types of grinding operations
- Honing, lapping and buffing operations
- Welding, types of welding
- Welding operation, gas welding, oxyfuel welding, arc welding, thermit welding
- Weld quality weld ability, weld design & weld materials
- NC CNC & DNC Machines, Coordinate Measuring Machine (CMM)
- Cold welding, ultrasonic welding, friction, filler, flux & electrode for welding & different Process. Weld quality weld ability, weld design & metals, process selection, adhesive bonding, joining plastics

Applied Mathematics-II (MS-153)

Course Outline

- Basic concepts and ideas of differential equation;
- Formation of differential equation;
- Separable equations,
- Equations reducible to separable form
- Exact differential equations
- Reducible to exact differential equations
- Linear first order differential equations,

- Bernoulli's differential equation.
- Families of curves, orthogonal trajectories
- Applications of differential equations of first order to relevant engineering systems.
- Homogeneous linear differential equations of second order
- Homogeneous equations with constant coefficients, the general solutions of initial and boundary value problems
- D-operator, complementary functions
- D-operator particular integrals.
- Complex and repeated roots of characteristics equations
- Non-homogeneous linear equations

Pakistan Studies (MH-122)

Course Outline

Historical Perspective:

- Ideological rationale with special reference to Sir Syed Ahmed Khan, Ideological rationale with special reference to Allama Muhammad Iqbal, Ideological rationale with special reference to Quaid-i-Azam Muhammad Ali Jinnah
- Factors leading to Muslim separatism
- People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and geo-physical features.

Government and Politics in Pakistan

- Political and constitutional phases: 1947-58, 1958-71, 1971-77, 1977-88, 1988-99, 1999 onwards

Contemporary Pakistan

- Economic institutions and issues
- Society and social structure, Ethnicity
- Foreign policy of Pakistan and challenges
- Futuristic outlook of Pakistan

Technical Drawing & CAD-I (MT-124)

Course Outline

Introduction to Engineering Drawing

- covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular, Hyperbola ,

Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales; Technical Drawing Standards General principles of presentation, conventional representation of dimensioning and sectioning, threaded parts, gears, springs and common features. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.

Technical Drawing Standards

- General principles of presentation, conventional representation of dimensioning and sectioning, threaded parts, gears, springs and common features. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.

Orthographic Projection:

- Principle and Methods of projection, Orthographic projection, Planes of projection, First and Third-angle projection, Reference line, Projection of Points: A point is situated in the first, second, third and fourth quadrant, Projection of Straight Lines: Line parallel and perpendicular to one or both the planes, Line contained by one or both the planes, Projections of lines inclined to one of the planes, True length of a straight line and its inclinations, Methods of determining traces of a line, Projections of lines inclined to both the planes, True length of a straight line and its inclinations, Methods of determining traces of a line.

Projection of Planes (2D):

- Types and Traces of planes, Projections of planes, Projections of oblique planes, Projection of planes inclined to one of the plane

Projections on Auxiliary Planes (2D):

- Projection of planes inclined to both the planes, Types of auxiliary planes and views
- Projection of a point on an auxiliary plane, Projections of lines and planes

Projections of Solids (3D):

- Types of solids and their projections, Projections of solids with axes inclined

Section of Solids (3D):

- Section of planes, prisms, pyramids, cylinders, cones, spheres,
- Methods of development, Triangulation development, Developments of lateral surfaces of right solids.
- Section of planes, prisms, pyramids, cylinders, cones, spheres,
- Methods of development, Triangulation development, Developments of lateral surfaces of right solids.

Isometric Projections (3D):

- Isometric axes, lines, planes, and scale, Isometric drawing or isometric view, Isometric drawing of planes or plane figures,
- Prisms and pyramids, cylinders, cones and sphere

Applied Thermodynamics-I (MT-134)

Course Outline

- Introduction to Thermodynamics, History, Applications
- Thermodynamic systems: Open, Closed, Isolated.
- States, processes, heat and work;
- Thermal Equilibrium, Thermodynamic Equilibrium, Zeroth law of Thermodynamics
- Enthalpy, First law of Thermodynamics, Applications
- Properties of pure substances and steam, Mollier diagram
- Second law of Thermodynamics, Applications
- Carnot cycle, entropy
- Corollaries of the second law
- Application of first and second laws to closed and open systems
- Irreversibility and availability, energy analysis
- Thermodynamic relations
- Properties of mixtures of ideal gases
- Thermodynamic cycles - Otto, Diesel, Dual and Joule Cycle
- Third Law of Thermodynamics

Basic Electrical and Electronics (MT-144)

Course Outline

- Basic concepts of voltage, current
- Resistance, capacitance, inductance
- Series circuits, Parallel circuits, Series parallel combination
- Calculations, Ohm law, law of resistance.
- Construction and Working principles of DC Machines.
- Speed control of DC motors
- Working principles and applications of AC machines
- Construction and working principles of single and three phase transformers
- Insulators, semiconductors, type of semiconductors
- Doping, PN-junction diode
- Rectifier and their types
- Construction and working principles of Bipolar junction transistors
- Working principles of Bi-polar junction transistors.
- Construction and working principles of BJT amplifiers.

Communication Skills (MH-213)

Course Outline

- Listening Skills- difference between hearing and listening
- Listening types, listening barriers,
- Suggestions to improve listening Skills
- Listening audios of native speakers and answering given questions from the audios
- Practicing listening skills
- Speaking Skills- difference between public speaking and conversation
- Group Discussion- introducing yourself
- Presentation Skills
 - Types of presentation
 - Types of Delivery
 - Delivery Techniques
 - Preparation
- Writing skills- types of writing, cohesion & coherence
- Types of sentence structure- simple, complex and compound sentences
- Summarizing
- Purpose, Technique, Practice of Paragraphs
- Professional Communication: types of official letter, job applications
- Practice writing skills
- Reading Skills- types of reading – scanning, skimming
- Reading sample texts for Question and Answer

CAD-II (MT-213)

Course Outline

UNIT 1: Introduction to 2D and 3D CAD

- 1.1 Modules, 1.2 Toolbars, 1.3 Units and Dimensions, 1.4 Important Terms and Definitions

UNIT 2: 2 D Sketch

- 2.1 Sketch Environment, 2.2 Drawing Display Tools, 2.3 Sketching Entities, 2.4 Pattern, 2.5 Tolerance, 2.6 Work Feature

UNIT 3: Dimension and Constraint

- 3.1 Dimension, 3.2 Geometric Constraint,
 - 3.2.1 Perpendicular Constraint, 3.2.2 Parallel Constraint, 3.2.3 Tangent Constraint, 3.2.4 Coincident Constraint, 3.2.5 Concentric Constraint, 3.2.6 Collinear Constraint,

3.2.7 Horizontal Constraint, 3.2.8 Vertical Constraint, 3.2.9 Equal Constraint, 3.2.10 Fix Constraint, 3.2.11 Symmetric Constraint, 3.2.12 Smooth Constraint,

- 3.3 Measurement

UNIT 4: 3D Sketch

- 4.1 Parameter, 4.2 3D Sketching Entities

UNIT 5: Solid Modeling

- 5.1 Modeling Tools,
 - 5.1.1 Extrude Feature, 5.1.2 Revolve Feature, 5.1.3 Holes Feature, 5.1.4 Fillets Feature, 5.1.5 Chamfers Feature, 5.1.6 Ribs Feature, 5.1.7 Thicken and Offset Feature
- 5.2 Concept of Edit Feature,
- 5.3 Advanced Modeling Tools
 - 5.3.1 Sweep Feature, 5.3.2 Lofted Feature, 5.3.3 Coil Feature
 - 5.3.4 Thread Feature, 5.3.5 Shell Feature, 5.3.6 Face Draft Feature, 5.3.7 Replacing Face Feature, 5.3.8 Boundary Patch Feature, 5.3.9 Stitching Surfaces Feature, 5.3.10 Sculpt Feature

UNIT 6: Assembly Modeling

- 6.1 Types of Assembly,
- 6.2 Assembly Component
 - 6.2.1 Mate Constraint, 6.2.2 Angle Constraint, 6.2.3 Tangent Constraint, 6.2.4 Insert Constraint, 6.2.5 Rotation Constraint, 6.2.6 Rotation-Translation Constraint, 6.2.7 Transitional Constraint
- 6.3 Edit Assembly Constraint

UNIT 7: Drawing View

- 7.1 Types of Views, 7.2 Drawing Standards, 7.3 Drawing Sheets, 7.4 Dimension Style 7.5 Parts Lists

UNIT 8: Presentation Module

- 8.1 Presentation View
- 8.2 Assembly Animation

Industrial Material (MT-223)

Course Outline

- Introduction to Engineering Materials
- Classification of Materials (Metal/Alloys, Polymers, Ceramics and Composites), their properties and applications
- Fundamentals of Crystal structures: Unit cells, crystallographic directions and planes
- Atomic packing in Crystal structures: Linear, Planar and Volumetric packing densities of different unit cells of ceramic crystal structures
- Allotropes of Iron, Phase diagrams: Binary phase diagram, Iron-Carbon phase diagram
- Types, structures, properties and applications of Polymers.

- Mechanical properties of metals: Types of different metals and alloys and their mechanical properties and their deformation.
- Metal Alloys, its properties and applications
- Types, structures, properties and applications of Composites
- Types, structures, properties and applications of Ceramics
- Heat Treatment processes and applications

Mechanics of Material (MT-233)

Course Outline

- Mechanical properties of Materials
- Elastic constants and their relationships
- Tensile stress, Compressive stress, Shear stress
- Strain (Longitudinal, Lateral and volumetric)
- Compound bars
- Thermal stress
- Moment of inertia
- Shear force and Bending moment of beams
- Shear stress and deflection of beams
- Torsion of circular bars, hollow and compound shafts
- Strain energy
- Thin and thick pressure vessels
- Plain stress and strain principal stress and strain, Mohr's circle
- Theories of failure
- Virtual work and associated energy theorems
- Photo elasticity and strain gauges

Applied Thermodynamics-II (MT-243)

Course Outline

- I C. Engines: Classification - SI, CI, two-stroke, four stroke etc., operating characteristics – mean effective pressure, torque and power, efficiencies, specific fuel consumption etc.
- Air standard cycles – Otto, Diesel and dual, real air-fuel engine cycles

- Thermochemistry of fuels – S.I. and C.I. engine fuels, self-ignition, octane number, cetane number, alternate fuels etc
- Combustion – combustion in S.I. and C.I. engines, pressure-crank angle diagram, air fuel ratio, chemical equation and conservation of mass in a combustion process etc., Air and fuel injection – injector and carburetor, MPFI etc., ignition, lubrication, heat transfer and cooling
- Gas Power Cycles: cycle Simple gas turbine cycle – single and twin shaft arrangements, intercooling, reheating, regeneration, closed cycles, optimal performance of various cycles, combined gas and steam cycles
- Introduction to Axial-Flow Gas Turbine; Introduction to Centrifugal and Axial Flow Compressors;
- Combustion Chambers; Jet Propulsion: turbojet, turboprop, turbofan, ramjet, thrust and propulsive efficiency; Rocket Propulsion
- Direct Energy Conversion: thermionic and the of working permoelectric converters
- Photovoltaic generators, MHD generators, fuel cells.

Machine Design (MT-253)

Course Outline

- Introduction: Definition, Understanding the Fits and Forms, Design Requirements of Machine Elements
- Design Procedure, Standards in Design, Selection of Preferred Sizes, Selection of Materials for Static and Fatigue Loads.
- Design methodology; Design criterion based on fracture; Deformation and elastic stability design stresses; Factor of safety; Significant stress and significant strength; Stresses concentration; Causes and mitigation; Endurance limit; Effect of concentration
- Notch sensitivity; Size and surface finish; Goodman diagram; Gerber's parabola and Soderberg line.
- Manufacturing Consideration in Design: Statistical Considerations, Selective Assembly, Design Consideration in Machining, Castings, Forgings, Welding. Reaction, Skraup synthesis, etc.
- Design Against Static Load: Modes of Failure, Factor of Safety, Principal Stresses, Stresses Due to Bending and Torsion
- Theories of Failure
- Design Against Fluctuating Loads: Cyclic Stresses, Fatigue and Endurance Limit, Stress Concentration Factor, Stress Concentration Factor for Various Machine Parts, Notch Sensitivity, Design for Finite and Infinite Life, Soderberg, Goodman Criteria.
- Design of Riveted Joints: Types of Riveted Joints, Failure of Riveted Joint, Efficiency of Riveted Joint, Design of Boiler Joints, Eccentric Loaded Riveted Joint.
- Design of Threaded Joint: Design of Bolted Joint, Eccentrically Loaded Bolted Joint.

- Power Screws: Forms of Threads, Multiple Threads, Efficiency of Square Threads, Trapezoidal Threads, Stresses in Screws, Design of Screw Jack.
- Sliding Contact Bearing: Types, Selection of Bearing, Plain Journal Bearing, Hydrodynamic Lubrication, Properties and Materials, Lubricants and Lubrication, Hydrodynamic Journal Bearing, Heat Generation, Design of Journal Bearing, Thrust Bearing-Pivot and Collar Bearing, Hydrodynamic Thrust Bearing.
- Rolling Contact Bearing: Advantages and Disadvantages, Types of Ball Bearing, Thrust Ball Bearing, Types of Roller Bearing, Selection of Radial Ball Bearing, Bearing Life, Selection of Roller Bearings, Dynamic Equivalent Load for Roller Contact Bearing Under Constant and Variable Loading, Reliability of Bearing, Selection of Rolling Contact Bearing, Lubrication of Ball and Roller Bearing, Mounting of Bearing.
- Assembly Drawing Of Machine Elements:(use CAD Software)

Fluid Mechanics (MT-264)

Course Outline

- Introduction, Classification of Mechanics, Development of fluid dynamics, distinction between solid and fluid, gas and liquid, properties of fluids
- Density, specific weight, specific volume, specific gravity
- Compressible and incompressible fluids, ideal fluids, viscosity and its units, surface tensions, vapor pressure of liquids, Capillarity.
- Fluid Statics: Pressure, variation of pressure in a static fluid, pressure head, review of types of pressures, pressure measurement gauges, Force on plane area, center of pressure, force on curved surface, Buoyancy and stability of submerged and floating bodies.
- Kinematics of Fluid Flow: Types of flow, flow rate and mean velocity, equation of continuity, flow net, velocity and acceleration in steady and unsteady flow.
- Measurement of flow rate velocity: Energy Consideration in Steady Flow: Kinetic energy of a flowing fluid, potential energy, internal energy, general equation for steady flow of any fluid, energy equation for steady flow of incompressible fluids, Bernoulli's theorem, Head, Power consideration in fluid flow cavitation's, energy equation for steady flow of compressed fluids, equation of steady motion along a stream line for ideal fluid and Euler's equation, Equation of steady motion along a stream line for real fluid, Hydraulic gradient, energy line, problems, Pressure in fluid flow and its measurement, set trajectory, flow in a curved path, vortex, types of vortex.
- Similitude and Dimensional analysis: Definition and importance, geometrical, kinematic and dynamic similarity, Dimensionless ratios, scale ratios, dimensional analysis.
- Steady & Incompressible Flow in Pressure conduits: Laminar and Turbulent flow, critical Reynolds number, Hydraulic radius, general equation for friction, Darcy-

Weisbach pipe friction equation, laminar flow in circular pipes, turbulent flow in circular pipes, pipe roughness, chart for friction factor, fluid friction in non-circular conduits, empirical equations for pipe flow, Flow measurements, Pitot tubes, venturimeter, orifices, nozzles

Engineering Statics (MT-273)

Course Outline

- General Principles: Introduction to the basic quantities and Idealizations of mechanics, Newton's laws of motion and gravitation, SI system of units, Standard procedures for performing numerical calculations, General guide for solving problems
- Force Vectors: Add forces and resolve them into components using the Parallelogram Law, Express force and position in Cartesian vector form and determine vector's magnitude and direction, Introduce dot product to determine the angle between two vectors or projection of one vector onto another
- Equilibrium of a Particle: Introduce concept of a particle free body diagram, solve particle equilibrium problems, Force System Resultants: Calculate moment of a force in two and three dimensions, Find the moment of a about a specified axis, Define the moment of a couple, Determine the resultants of non-concurring force systems, Reduce a simple distributed loading to a resultant force.
- Equilibrium of a Rigid Body: Develop equations of equilibrium for a rigid body, introduce the free-body diagram for a rigid body, Solve rigid-body equilibrium problems.
- Structural Analysis: Determine forces in the members of a truss, Analyze forces acting on pin-connected members of frames and machines.
- Internal Forces: Determine the internal loadings in a member using the method of sections, Formulate equations that describe internal shear and moment throughout a member, Analyze forces and geometry of cables supporting a load
- Friction: Analyze the equilibrium of rigid bodies subjected to dry friction, Present applications of frictional force analysis on wedges, screws, belts, and bearings, Investigate the concept of rolling friction
- Center of Gravity and Centroid: Discuss the concept of center of gravity, center of mass, and the centroid, Determine the location of the center of gravity and centroid for a system of discrete particles, Find the area and volume for a body having axial symmetry using the Pappus and Guidinus theorems, Find the resultant of a general distributed loading and apply it to finding the resultant force of a pressure loading from a fluid
- Moments of Inertia: Determine the moment of inertia for an area, Determine the minimum and maximum moments of inertia for an area using the product of inertia

Probability and Statistics (MS-213)

Course Outline

- Basic concept of probability
- Conditional probability
- Independent events, Baye's formula.
- Concept of random variables, discrete and continuous one and two dimensional random
- Variables, probability distributions
- Marginal and joint distributions and density functions.
- Binomial Distribution
- Poisson Distribution
- Uniform Distribution
- Normal Distribution
- Exponentials and Hyper-geometric Distribution
- Mean, variance
- Moments and moment generating functions
- Linear regression and curve fitting
- Central limit theorem, autocorrelation and cross-correlations
- Power spectral density functions and stochastic processes.

Total Quality Management (MM-212)

Course Outline

- Definition of quality – Deming, Miller – Crosby Theories – Service and Product quality – Customer orientation.
- Evaluation of Total quality Management – Inspection – Quality Control – TQM System – Human component
- Introduction to Six Sigma concepts
- Planning – SMART Goal setting – Designing for Quality
- Manufacturing for Quality – Process control – CPK – Process capability
- Scientific Approach to TQM
- Data based approach – Quantification – Statistical tools
- Quality control tools – New 7 tools
- Sampling and Control Charts

- TQM Techniques Benchmarking
- Definition – Types – Steps – Metrics – Case studies
- Quality Function Deployment – Definition – steps – Case studies
- Corrective Techniques – Preventive techniques – Failure Mode and Effect Analysis
- 5S. Continuous Improvement Techniques – Different techniques such as POKA YOKE etc. – Deming wheel – Case studies
- Reliability Definition, Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study
- Use of control charts. Attributes of Control Charts Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.
- Defects Diagnosis and Prevention Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Technical Report Writing (MH-223)

Course Outline

- Essay writing: Descriptive, narrative, discursive, argumentative.
- Academic writing: How to write a proposal for research paper/term paper. How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency).
- Technical Report writing.
- Progress report writing.
- Technical document creation with tools and technique to improve quality. Structure, layout and writing style for various technical documents for both print and digital media. Document review process and assessment of written report and documents.
- Technical Communication Basics, A General Definition of Technical Communication, Major Traits of Technical Communication, Globalization and Cultural Awareness.
- The Technical Communication Process. An Overview of the Process, Planning Document, Drafting and Finishing, Document, Editing.
- The Uses of Visual Aids, Planning the Mechanism Description, Writing the Mechanism Description.
- The Elements of a Formal Report, Planning the Recommendation Report, Drafting the Recommendation Report, Planning the Feasibility Report, Writing the Feasibility Report, Ethics and Proposals.

- Writing the Internal Proposal, Planning the Manual, Writing the Manual, Making an Effective Presentation.

Heat Transfer (MT-313)

Course Outline

- Introduction: Heat and Mass transfers. Applications of Heat and Mass Transfers in our everyday activities, Modes of heat transfer
- Basics of Heat Conduction, Energy balance and the general conduction equation, 1-Dimensional and 3-Dimensional Conduction Analysis
- Steady State Heat Conduction, Conduction in plane walls; multilayer plane wall; spheres and cylinders, with and without heat generating sources
- Overall Heat transfer coefficient, Critical thickness of insulation
- Fins and heat transfer through extended surfaces, Fin equations, Fin efficiency, effectiveness
- Fundamentals of Convection, Fluid flow and heat transfer; energy equation
- Convective heat transfer from flat plate; dimensional analysis Laminar and turbulent flow, Derivation of differential convection equations, Free and Forced Convection
- Heat Exchanger Types; Classification, Log mean temperature analysis, Effectiveness-NTU method
- Fundamentals of radiation heat transfer, Stefan Boltzmann's law, black body radiation, absorptivity, reflectivity, transmissivity
- Radiation shape factor and its applications, Solving Problems; Radiation and Heat Exchangers, Heat-Exchanger Design Consideration

IC Engine (MT-324)

Course Outline

- Working fluid before combustion, valve and port timing diagrams. Thermodynamic properties of fuel-air mixture before combustion.
- Use of combustion charts for unburned mixture. Use of combustion charts for burned mixture. Estimating air capacity for four stroke engine.

- Appropriate treatment of fuel air mixtures. Fuel air cycles, Definition, constants, volume fuel air cycle, limited pressure cycle.
- Characteristics of fuel-air cycles, comparison of real and fuel cycles.
- Volumetric Efficiency, Factor affecting vol. efficiency, Effect of atmospheric conditions, altitude and compression ratio on IC Engine performance
- Combustion and fuel characteristics, ignition, knocking and detonation, effect of engine variable on knocking
- IC Engine criterions, indicating power, brake power, thermal efficiency, specific fuel consumption.
- IC Engine process analysis, air standard cycle compression ratio, thermal efficiency and heat balance, brake specific fuel consumption.
- Scavenging process, scavenging stages, theoretical scavenging.
- Supercharger and turbocharger, types of supercharger, components of turbocharger.
- Mixture requirements, air fuel ration, stoichiometric air fuel ratio, mixture requirements for SI engines, alternative fuel used in IC engine.
- Fuel injection system of IC engine, types of injection system, advantages and disadvantages of various injection systems.
- Ignition system, system requirements, types of ignition systems, advantages and disadvantages if various ignition systems.
- IC Engine cooling systems, reasons of cooling, effect of overcooling, types of cooling systems.
- Friction and lubrication of IC Engine, factors affecting friction, lubrication properties.
- IC Engine carburetion systems, principles of operation, types of carburetion systems.

Dynamics (MT-333)

Course Outline

- Applied Mechanics, Types, Applications
- Kinematics of Particles: Rectilinear motion
- Dependent Motion
- Plane curvilinear motion
- Projectile Motion
- Rectangular Coordinate System
- Normal and tangential coordinates
- Polar coordinates
- Work and energy
- Impulse and momentum, conservation of momentum
- Plane Kinematics of Rigid Bodies. Angular motion relations, absolute motion, relative velocity
- Instantaneous Centre of zero velocity, relative acceleration.

- Plane Kinetics of Rigid Bodies: Force, mass, and acceleration,
- Equation of motion, translation, fixed axis rotation, general plane motion,
- Work and energy relationship, impulse and momentum equation.

Manufacturing Processes (MT-343)

Course Outline

- Introduction to Manufacturing Processes and their Classification
- Industrial Safety; Introduction, Types of Accidents, Causes and Common Sources of Accidents, Methods of Safety, First Aid.
- Material Removal: Mechanics of chips formation, Types of chips produced, Chip breakers, Orthogonal & Oblique cutting, Cutting forces in conventional turning, Friction & heat sources in cutting, Surface finishing processes, Lapping, Honing, Super finishing, Polishing, Buffing, Electroplating, Galvanizing, Metal spraying
- Foundry: Introduction to Casting Processes, Basic Steps in Casting Process, Pattern, Types of Patterns, Pattern Allowances, Risers, Runners, Gates, Moulding Sand and its composition, Sand Preparation, Molding Methods, Core Sands and Core Making, Core Assembly, Mold Assembly, Melting (Cupola) and Pouring, Fettling, Casting Defects and Remedies
- Cold Working& Hot Working processes: Sheet Metal Operations, Measuring, Layout Marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining Advantages and Limitations, Hot Working Processes: Introduction to Hot Working, Principles of Hot Working Processes, Forging, Rolling, Extrusion, Wire Drawing
- Introduction to Machine Tools& Processes: Specifications and Uses of commonly used Machine Tools in a Workshop such as Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting. Nomenclature of a Single Points Cutting Tool and Tool Wear. Mechanics of Chips Formations, Type of Chips, Use of Coolants in machining. Broaching & broaching machines, Press machine, Types of Press machines, Press work operations.
- Jigs & Fixtures: General Design principle, Elements of Jig, Locating Devices & Clamping Devices

Project Management (MM-313)

Course Outline

- Introduction to Management, History, Characteristics, and Functions of Management, Introduction to Management, Project Management, Difference between Management and Project Management, Functional Manager and Project Manager
- Organizational Structure, Types and Levels of Organizations, Properties of Organizations, Types of Management Styles, Levels of Management. Project Management, Scope of Project Management, Importance of Project Management in organizations, and Importance of Project Management in engineering field
- What is a Project, Building Blocks of a Project, Characteristics of Projects, and Phases of a Project, Project Manager Skills, Introduction to Project Organization, Difference between Organization and Project Organization, Project Organizational Structure Types: Functional, Projectized and Matrix Organization, Advantages and Limitations of Project Organization, Matrix Organization and its Types, Advantages and Disadvantages of Matrix Organization, How to Overcome the Disadvantages of a Matrix Organizational Structure, Role of Functional Manager and Project Manager in Organizations and Projects.
- Production Processes: Types of production, scale of production, selection of technology, input requirements, capacity utilization, productivity basic concepts, classification, quantitative measurement, productivity improvement.
- Introduction to Project Management Tools, Project Network Analysis, Work Breakdown Structure, Gantt Chart, Activity on Arrow and Activity on Node Diagram, PERT Technique, CPM Technique
- Inventory Management: Inventory replenishment, economic lot size, re-order point, safety stock level, JIT, computer tools
- Human Resource Management: Management Styles, Psychological Types, Recruitment and Training Job Evaluation, Performance Appraisal, Motivation and Incentives.

Economics (MH-312)

Course Outline

- Basic Economic Concept: Meaning, Nature and Scope of Economics, Methodology of Economics: Deductive vs Inductive Economics, Static and Dynamics, Basic Economic Problems: Scarcity and Choice, Relation between Science, Engineering, Technology and Economics.
- The Economic Environment: Consumer and Producer Goods, Measure of Economic

- Worth, Price, Supply, and Demand Relationship, Production, Factors of Production, Laws of Return in Economics
- Cost Concepts Analysis: Sunk and Opportunity Cost, Fixed, Variable, and Incremental Costs, Recurring and Non-Recurring Costs, Direct, Indirect, and Overhead Costs, Standard Costs, Breakeven Analysis, Unit Cost of Production, Cost Benefit Analysis, Feasibility Studies, Value Analysis in Designing and Purchasing, Taxation Details
- Depreciation and Depletion: Purpose of Depreciation, Types of Depreciation, Depreciation and Depletion: Economic Life, What can be depreciated? Depreciation problems.
- 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 and Mathematical Models: Manufacturing Lead Time, Production Rate, Capacity Utilization, Availability, Work in process, WIP and TIP Ratios
- Industrial Relations: Labor Problems, Labor Organizations, Prevention and Settlement of disputes

Instrumentation and Control (MT-353)

Course Outline

- Introduction to control system
- Input & output of control system.
- Open loop control system.
- Closed loop control system.
- Feedback control system.
- Elements of a general control system & their examples.
- Transfer function
- Transducers, Classification of Transducers
- Study of different indicating, measuring & recording instruments for length force.
- Torque, frequency, pressure, flow & temperature.
- Free body Diagram and Newton's law of motion
- Operational notation, grounded chair representation
- Series & parallel laws. Equation of motion for a spring mass & damper system,
- Electrical & Mechanical analogous circuits.
- Concept, root criterion & root locus method for stability measurements.

Mechanical Vibration (MT-363)

Course Outline

- Introduction to modeling and analysis, Introduction to mechanical vibration.
- Free vibration of single degree of freedom systems: Un-damped vibration; Simple harmonic motion, Damped vibration
- Modeling: Energy method, Raleigh's Energy Method, Newton's methods
- Measurement of vibration components; Design Consideration; Stability
- Forced harmonic excitation of single degree of freedom systems: Un-damped vibration, Damped vibration
- Forced harmonic excitation of single degree of freedom systems: Base excitation, Rotating Unbalance
- Coulomb damping Vibration of single degree of freedom systems under general forcing conditions: Impulsive inputs, Coulomb damping Vibration of single degree of freedom systems under general forcing conditions: Arbitrary non-periodic inputs, Arbitrary periodic inputs
- Stability Vibration of multi degree of freedom systems: Modeling, Free un-damped vibration
- Eigenvalue problem, Modal Analysis
- Free damped vibration; Forced vibration, Dynamic vibration absorbers; Isolators for shock and harmonic loading.

Refrigeration and Air Conditioning (MT-373)

Course Outline

- Introduction to refrigeration, History of refrigeration, thermodynamic system, path and point functions, thermodynamic process, cycle, heat, work, State the four fundamental laws of thermodynamics
- Apply first law of thermodynamics to closed and open systems and develop relevant equations, internal energy and enthalpy Discuss the importance of second law of thermodynamics and state Carnot theorems.
- Define and distinguish the differences between heat engine, refrigerator and heat pump, Obtain expressions for Carnot efficiency of heat engine, refrigerator and heat pump, State Clausius inequality and introduce the property 'entropy'

- Basic Terms used in Refrigeration, Refrigeration machine, The Carnot cycle, Vapor as refrigerant in Reversed Carnot cycle, Gas as refrigerant in Reversed Carnot cycle, Limitation of Reversed Carnot cycle, COP
- Vapor Compression System, Modifications in Vapor Compression System, Wet Compression Vs. Dry Compression
- Bell Coleman Cycle
- Simple Vapor Absorption system, Maximum Coefficient of performance of a heat operated Refrigeration machine, Common Refrigeration Absorption systems, Water and lithium bromide absorption system, Single effect and double effect absorption cycle
- Psychometry, Properties of Air, water vapor in the air, Relationship between pressure of air and pressure of water vapor, Humidity, Temperature, Dew point and Wet bulb Depression, Enthalpy of Moist air, Adiabatic saturation of air, Relationship between humidity ratio and dry bulb and wet bulb temperature, specific volume of moist air, Specific heat of moist air, Psychometric chart, Sensible heating and cooling, Heating with humidification, cooling with dehumidification, By Pass factor, Sensible Heat factor
- Introduction of refrigerant, Development of refrigerant, Classification of refrigerant, Designation of refrigerant, Requirement of selection of refrigerant, Safety procedure, common refrigerant
- Application of Refrigeration and Air condition, Cold storage, Ice Making, Window type AC, Split AC, Package Type, Cooling Towers, Air washers, Chiller

Material Handling and Safety (MT-384)

Course Outline

- The material-handling problem: Introduction, Material Handling Equipment Marketing, Principles of material handling, factors affecting material handling
- Bulk-Material-Handling Equipment: Belt Conveyers, Bucket Elevators and Bucket Conveyers, Screw Conveyers, Vibratory Conveyers, Feeders and Screws, Vehicle Bulk Handling Systems, Marine Bulk-Material Handling.
- Packaged-Material-Handling Equipment: Pallets and Palletizing Operations, Package and Unit Conveyor Systems, Belt Package Conveyor, Power Roller conveyor, Conveyor Turns and Switches, Conveyor Sortation and Accumulation Systems, Pallet Conveyers.
- Monorail conveyor Systems: Light Duty Chain and Cable System, Heavy Duty Systems, Power-and-Free Systems, Powered-Carrier Monorail Systems
- Counterbalanced Forklift Trucks: Reach-Type Non-Aisle Forklift Trucks, Narrow-Aisle Turret-Type Forklift Trucks, Side-Loading Forklift Trucks
- Miscellaneous Material Handling Equipment Vehicular Unit Handling equipment, Pallet Transporters and Material Handling Tools. Towline Systems, Tractor-Trailer Trains.

- Integrated Material Handling Systems: Automated Guided Vehicles and Their Applications, Use of Robots
- Classification of Health hazards. Physical, chemical, biological. Sources of risk
- Machinery Noise, Electrical failure, ventilation, lighting, radiation, Dangerous substances
- Classification, Entry & Exit routes, safe handling, Health & safety regulation & policy.
- Safety Machining & Guarding, Preventing Machining accidents, Machine guarding Equipment & Machine handling
- Mechanical & Manual Handling, Access Equipment, Transport, Electricity & Electrical Equipment.
- Fire:-Classification, fire protection, means of Escape, Actions to be taken. Chemical safety Personal protection.
- Safety Management Accident prevention, health & safety training, Communicating safety measures.