Mechanical Engineering Department

ME 102 ENGINEERING DRAWING

Drawing equipment and the use of instruments, Basic drafting techniques and standards, Geometrical curves including plane curves, Cycloid, Hypocycloid and involute. Intersections at various positions of geometrical bodies such as prisms, Pyramids, Cylinders and cones: Development of surfaces of prisms, Pyramids, Cylinders and cones.


Concept of working drawing of component parts of machines and engines size description, Dimensions and specifications, Limit dimensioning and geometric tolerancing, Limits; Fits and tolerances, Conventional symbols.

Sectioning of machine and engine components, Orthographic projections and standard practices.

ME 103 THERMODYNAMICS

Thermodynamic Properties

Energy and its conservation
Relation of mass and energy, Different forms of energy, Internal energy and enthalpy, Work, Generalized work equation, Flow and non flow processes, Closed systems, First law of Thermodynamics, Open systems and steady flow, Energy equation for steady flow, System boundaries, Perpetual motion of the first kind.

Energy and property relations
Thermodynamic equilibrium, Reversibility, Specific heats and their relationship, Entropy, Second law of Thermodynamic property relation from energy equation, Frictional energy.

Ideal Gas
Gas laws, Specific heats of an ideal gas, Dalton’s law of partial pressure, Third law of Thermodynamics, Entropy of an ideal gas, Thermodynamic process.

Thermodynamic Cycles
Cycle work, Thermal efficiency and heat rate, Carnot cycle, Sterling cycle, Reversed and reversible cycles, Most efficient engine.

Consequences of the Second Law
Clausius inequality, Availability and irreversibility, Steady flow system.

Two-Phase Systems:
Two phase system of a pure substance, Changes of phase at constant pressure, Steam tables, Superheated steam, Compressed liquid and vapour curves, Phase diagrams, Phase roles, Processes of vapours, Mollier diagram, Rankine cycle, Boilers and ancillary equipment.

Internal Combustion Engines
Otto cycle, Diesel cycle, Dual combustion cycle, Four stroke and two stroke engines, Types of fuels.

Reciprocating Compressors
Condition for minimum work, Isothermal efficiency, Volumetric efficiency, Multi-stage compression, Energy balance for a two stage machine with intercooler.

ME 104 WORKSHOP PRACTICE

Use of carpenter’s tools, Exercise in preparing simple joints, Bench fitting practice, Exercise in marking and fittings, Use of measuring instruments.

Smith’s forge, Exercise in bending, Upsetting and swaging.

Familiarizing the students with the following processes:

Soldering and brazing, Welding, Heat treatment, Moulding and casting.

Simple machine shop processes, Such as turning, shaping, Milling and sheet metal work.
ME 105 APPLIED THERMODYNAMICS

**Thermodynamic Properties:**

**Energy and its Conservation:**
Relation of mass and energy, Different forms of energy, Internal energy and enthalpy, Work, Generalized work equation, Flow and 3 non-flow processes, Closed systems, First Law of Thermodynamics, Open systems and steady flow, Energy equation of steady flow, System boundaries, Perpetual motion of the first kind.

**Energy and Property Relations:**
Thermodynamics equilibrium, Reversibility, Specific heats and their relationship, Entropy, Second Law of Thermodynamics, Property relations from energy equation, Frictional energy.

**Ideal Gas:**

**Thermodynamics Cycles:**
Cycle work, Thermal efficiency and heat rate, Carnot cycle, Stirling cycle, Reversed and reversible cycles, Most efficient engine.

**Consequences of the Second Law:**
Calusius’s inequality, Availability and irreversibility, Steady flow system.

**Two-phase Systems:**
Two-phase system of a pure substance, Changes of phase at constant pressure, Steam tables, superheated steam, Compressed liquid, Liquid and vapour curves, Phase diagrams, Phase roles, Processes of vapours, Mollier diagram, Rankine cycle, boilers and ancillary equipment.

**Internal Combustion Engines:**
Otto cycle, Diesel cycle, Dual combustion cycle, Four-stroke and two-stroke engines, Types of fuels.

**Reciprocating Compressors:**
Condition for minimum work, Isothermal efficiency, Volumetric efficiency, Multi-stage compression, Energy balance for a two-stage machine with intercooler.

ME 106 STATICS

**Statics of Particles**
Forces in a plane, Equilibrium of a particle, Newton’s first law, Free body diagram, Forces in space (rectangular components), Equilibrium of a particle in space.

**Rigid Bodies**
Equivalent systems of forces, Principle of transmissibility, Moment of a force, Couple, Varignon’s theorem.

**Equilibrium of Rigid Bodies**
Free-body diagram, Equilibrium in two and three dimensions, Reaction at supports and connections, Equilibrium of two-force and three force bodies.

**Analysis of structures**
Internal forces and Newton’s Third Law, Trusses, Simple and space trusses, Methods of joints and sections, Frames and machine analysis.

**Forces in Beams and Cables**
Shear force and bending moment diagrams, Cables with concentrated and distributed loads.

**Friction**
Laws of dry friction, Coefficient of friction and angles of friction, Wedges, Square-threaded screws, Journal and thrust bearings, Belt Friction.

**Distributed Forces**
Centroids and centers of gravity, Areas and lines, Composite plates and wires, Distributed loads on beams, Forces on submerged surfaces, Center of gravity of a three dimensional body and centroid of a volume.
Second moment of area and moments of inertia, Polar moment of inertia, Radius of gyration, Parallel axis theorem.
Method of Virtual Work
Work of a force, Virtual work, Real machines and mechanical efficiency, Potential energy and equilibrium, stability of equilibrium.

CY 109 APPLIED CHEMISTRY

Gases
Gas laws, Kinetic gas equation, Vander Waal’s Equation, critical phenomenon, Liquidification of gases, Specific heat (molar heat capacity).

Properties of Solutions and Liquids
Surface tension, Viscosity, Osmosis, Osmotic pressure, PH-Buffer Solution, Spectrophotometer, Basic concepts of colloidal chemistry, Classification purification (Dialysis).

Thermochemistry
Chemical thermodynamics, Hess’s Law, Heat of reaction, Relation between H and U, measurement of heat of reaction, Bomb calorimeter.

Electrochemistry

Water and Sewage
Sources of water, Impurities, hardness, Water softening, Purification of water for potable and industrial purposes, Electrodialysis, Introduction to environmental pollution, Main sources and effects, Sewage treatment.

Fuels
Types of fuels, Classification of fossil fuels.

Metals and Alloys
Properties and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium and zinc used in engineering field.

Engineering Materials

Practical
Determination of total alkalinity of a given sample, Determination of total acidity of a given sample, Determination of the amount of ferrous ions in a given sample: Determination of total hardness of a given sample of water, Determination of surface tension of a given sample, Determination of coefficient of a given sample, Determination of chloride ions in a given sample, Determination of bicarbonate and Carbonate ions in a given sample, Determination of turbidity in a given sample by precipitation, Determination of turbidity in a given sample by spectrophotometer, Plotting of titration curve and determination of total alkalinity in a given sample, Plotting of titration curve and determination of acidity in a given sample, Plotting a calibration curve and determination of ions present in a given sample.

MT 111 CALCULUS

Set and Functions
Define rational, Irrational and real numbers, Rounding off a numerical value to specified number of decimal places or significant figures, Solving quadratic and rational inequalities in involving modulus with graphical representations, Definition of set, Set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, Greatest integer and combining functions). Graph of some well-known functions, Limit of functions and continuous and discontinuous functions with graphical representation.

Propositional Logic
Definition of Proposition, Statement and argument, Logical operators, Simple and compound proposition, various types of connectives, Truth table, Tautology, Contradiction, Contingency and logical equivalence.

Boolean Algebra
Definition, Boolean function, Duality, Some basic theorems and their proofs, Two valued Boolean algebra, Truth functions, Canonical sum of product form, Digital logic Gates and switching circuit designs.

Complex Number
Argand diagram, De moivre formula, Root of polynomial equations, Curve and regions in the complex plane, Standard functions and their inverses (exponential, circular and Hyperbolic functions).

Differential Calculus
Differentiation and successive differentiation and its application, Leibnitz theorem, Taylor and maclaurin theorems with remainders in cauchy and lagrange form, Power series, Taylor and maclaurin series, L’Hôpitals rule, Extreme values of a function of one variable using first and second derivative test, Asymptotes of a function, Curvature and radius of curvature of
a curve, Partial differentiation, Exact differential and its application in computing errors, Extreme values of a function of two
variables with and without constraints, Solution of non-linear equation, using Newton Raphson method.

**Integral Calculus**
Indefinite integrals and their computational techniques, Reduction formulae, Definite integrals and their convergence, Beta
and Gamma functions and their identities, Applications of integration, Centre of pressure and depth of centre of pressure.

**Solid Geometry**
Coordinate systems in three dimensions, Direction cosines and ratios, Vector equation of a straight line, plane and sphere,
Curve tracing of a function of two and three variables, Surfaces of revolutions, Transformations (Cartesian to polar and
cylindrical).

**CE 103 ENGINEERING SURVEYING – I**
General Principles of Surveying, Determination and plotting of positions, Scales, Errors and degree of accuracy required.

**Chain Surveying**
Chains and tapes, Optical square and other instruments, Ranging and chaining line errors in chaining,
Field book, Plotting chain survey, Obstacle surveying.

**Compass surveying**
Prismatic and surveyor’s compasses, Meridians, Bearings, Declination and local attraction traversing, Adjustment of
compass surveying.

**Theodolite Surveying**
Types of theodolites and their structure handling and care of instruments, Temporary adjustment of Theodolite, Measurement
of Bearings and horizontal and vertical angles, Use of theodolite as leveling instrument.

**Plane Table Surveying**
Plane table and accessories, Adjustment and orientation methods of plane table surveying, Merits and demerits of plane
tablimg, Contouring with tangent clinometers, Two point and three point problems.
Box sextant structure adjustment and use for measuring angles.

**Leveling**
General principles of leveling, Optics of surveying, Telescope and their structure, Types of levels, Temporary and permanent
adjustment, Methods of leveling, Level books, Reduction of levels and checks.
Leveling for longitudinal section and cross section, Plotting precautions in leveling, Sources of error,
Corrections for covalence and refraction.

**HS 105 PAKISTAN STUDIES**

**Historical and Ideological Perspective of Pakistan Movement**
Two nation theory. Definition: Claim of Muslims of being a separate nation from Hindus, based upon cultural diversity,
Significance: Cultural diversity and interests led to the demand of Pakistan – Lahore resolution, Creation of Pakistan, Factors
leading to the creation of Pakistan, Quaid-e-Azam and the demand of Pakistan.

**Land of Pakistan**
Geo-physical conditions, Geo-political and strategic importance of Pakistan, Natural resource mineral, water and power.

**Constitutional Process**
Early efforts to make a constitution (1947-1956) problems and issues, Salient features of the Constitution of 1956 and its
abrogation, Constitution of 1962 and its abrogation, Constitutional and Political crisis of 1971, Salient features of the
Constitution of 1973, constitutional developments since1973 to date with special reference to the amendments to
constitutions.

**Contemporary issues in Pakistan**
A brief survey of Pakistan Economy, an overview of current economic situation in Pakistan: problems issues and future
prospects, Social Issues, Pakistani Society and Culture-Broad features, Citizenship: national and international, Literacy and
education in Pakistan: problems and issues, State of Science and Technology in Pakistan: a comparison with other countries
with special reference to the Muslim world, Environmental issues, Environmental pollution and its hazards, causes and
solutions, Environmental issues in Pakistan: government policies and measures and suggestions for improvement, Pakistan’s
role in the preservation of nature through international conventions / treaties.

**Pakistan’s Foreign Policies**
Evolution of Pakistan foreign policy-1947 to date, A brief survey of Relation with Neighbours, Super Powers and the
Muslim World.

**Human Rights**
Conceptual foundations of Human Rights, What are Human Rights? Definition, origins and Significance, Comparative
analysis of Islamic and Western Perspective of Human Rights, UN System for protection Human Rights, UN Charter,
International Bill of Human Rights – an overview, Implementation mechanism, Other important international treaties and conventions, The convention on the elimination of all forms of discrimination against women (CEDAW), International Convention on the rights of child (CRC), Convention against torture (CAT), Other treaties and convention, Pakistan’s response to Human Rights at national and international levels, Constitutional provisions, Pakistan’s Obligations to international treaties and documents, Human Rights issues in Pakistan – a critical analysis, Pakistan’s stand on violation of Human Rights in the international perspective.

**HS 127 PAKISTAN STUDIES (FOR FOREIGNERS)**

**Contemporary Issues in Pakistan:**

A brief survey of Pakistan’s Economy
Agricultural and industrial development in Pakistan, Internal and external trade, Economic planning and prospects

Social issues
Literacy and education in Pakistan, State of science and technology with special reference to IT education, Pakistan society and culture.

Environmental issues
Hazards of atmospheric pollution, Other forms of environmental degradation, their causes and solutions, Pakistan’s role in preservation of nature through international conventions/efforts.

Foreign Policy
Relations of Pakistan with neighbours, Relations with Super powers, Relations with Muslim world.

Human Rights: Conceptual foundations of Human Rights
What are Human rights? Definition, significance and importance, Comparative analysis of Islamic and western Perspectives of Human rights.

UN System for Protection of Human rights - an over-view

Other important international treaties and conventions
The convention on the elimination of all forms of discrimination against woman, International Convention on the rights of child (CRC), Convention against torture (CAT), Refugee Convention.

Pakistan’s response to Human rights at national and international level
Constitutional Provisions, Pakistan’s obligations to international treaties and documents, Minority rights in Pakistan, Pakistan’s stand on violation of Human rights in the international perspective.

**PH 122 APPLIED PHYSICS**

**Introduction**
Scientific notation and significant figures, Types of errors in experimental measurements, Units in different systems, Graphical techniques (Log, Semi-log and other non-linear graphs)

**Vectors**
Review of vectors, Vector derivatives, Line and surface integrals, Gradient of scalar.

**Mechanics**

**Electrostatics and Magnetism**
Coulomb’s law, Electrostatic potential energy of discrete charges, Continuous charge distribution, Gauss’s law, Electric field around conductors, Dielectrics, Dual trace oscilloscope with demonstration, Magnetic fields, Magnetic force on current, Hall effect, Biot-Savart law, Ampere’s law, Fields of rings and coils, Magnetic dipole, Diamagnetism, Para-magnetism and ferromagnetism.

**Semiconductor Physics**
Energy levels in a semiconductor, Hole concept, Intrinsic and extrinsic regions, Law of mass action, P-N junction, Transistor, Simple circuits.

**Waves and Oscillations**
Free oscillation of systems with one and more degrees of freedom, Solution for modes, Classical wave equation, Transverse modes for continuous string, Standing waves, Dispersion relation for waves, LC network and coupled pendulums, Plasma oscillations.

**Optics and Lasers**
Harmonic traveling waves in one dimension, Near and far fields, Two-slit interference, Huygens principle, Single-slit diffraction, Resolving power of optical instruments, Diffraction grating.
Lasers, Population inversion, Resonant cavities, Quantum efficiency, He-Ne, Ruby and CO₂ lasers, Doppler effect and sonic boom.

**Modern Physics**
Inadequacy of classical physics, Planck’s explanations of black body radiation, Photoelectric effect, Compton effect, Bohr theory of hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis Braggs Law, Electron microscope, Uncertainty relations, Modern atomic model, Zeeman effect, Atomic nucleus, Mass energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life, Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation, Nuclear radiation hazards and safety, Medical uses of Nuclear radiation, Fission, Energy release, Nuclear reactors, Breeder reactor, Nuclear fusion.

**HS 101 ENGLISH**

**Study Skills**
Reading, dictionary, library skills, speed reading, writing outlines, note taking,

**Oral communication**
Confidence building, class discussions, speeches, verbal interaction

**Advanced reading comprehension:**
Using texts dealing with science, literature and human rights (as per HEC recommendation.)

**Précis writing**
Rules of précis writing, practice précis.

**Controlled and guided writing**
Pre writing (planning, information gathering, preparing to write), writing, search for topic sentences, developing a theme, following up ideas and arguments, outline plans etc.

**Essay writing**
Types of writing – narrative, descriptive, expository, argumentative etc. Using guided writing to organize essays., Including human rights as essay topics (as per HEC recommendation).

**Writing short reports**
Short background of report and its importance, memo report, brief reports on events seen / experienced like visit to an exhibition etc.

**Letter writing**
format and layout, formal letters, types of letters – invitations (acceptance and refusals), condolence, thanks, congratulations, to the editor, chairman class advisor, dean, vice chancellor etc.

**Applied Grammar**
Morphology, types of sentences, sentence analysis, tenses, jumbled sentences, question tags, homonyms and homophones and their use in sentences, punctuation – sentences and paragraphs, use of idioms

**EE 116 Principle of Electrical Engineering**

**Electric and Magnetic Circuits:**

**AC Single Phase and Poly phase Systems:**
Single Phase systems, Series, Parallel and series parallel circuits, J operator method and polar method. Resonance and measurement of power and power factor. Poly phase systems, Poly phase generation, Star and Delta connections, Voltage and current relations, measurement of power and power factor, Balanced load analysis.

**DC Machines:**
Construction and principle of DC machine, Simple lap and wave windings, Concept of annature reaction and commutation Cross and demagnetizing ampere turns, DC Generators, Types emf equation, Losses, Efficiency principle Back EMF, Speed
AC Synchronous Machines:

AC Induction Machines:

Transformers:
Construction, Principle of working, EMF equation, Transformation ratios, No load working and vector diagram, Magnetizing current, Vector diagram on load, Equivalent circuit, Open circuit and short circuit tests, Losses, Efficiency and performance curves, All day efficiency, Percentage and per unit R, X and Z. Voltage regulation.

Rectifiers and Applications:
Rectification, Half Wave and Full Wave Rectifiers simple treatment, Elementary concept of amplification with transistor used as amplifier in common emitter configuration.