

# **FIRST YEAR**

## **FALL SEMESTER**

### **PH-122 APPLIED PHYSICS\***

#### **Introduction**

Types of errors and error calculation, Graphical Techniques (Log, semi-log and other non-linear graphs)

#### **Vectors**

Coordinate systems, review of vectors, Vector differentiation (ordinary and partial differentiation), vector integrations.

#### **Mechanics**

Motion under constant acceleration, Newton laws and their applications. Frictional forces, work energy theorem, law of conservation of mechanical energy, Angular momentum.

#### **Electrostatics and Magnetism**

Coulombs Law, Continuous charge distribution, Electrostatic potential energy of discrete charges, Gauss's Law, Electric field around conductors, Magnetic fields, Magnetic force on current, Hall effect, Biot & Savart Law, Ampere's Law, Fields of rings and coils, Magnetic dipole. Diamagnetism, Paramagnetism and Ferromagnetism.

#### **Semiconductor Physics**

Energy levels in a semiconductor, Hole concept, Intrinsic and Extrinsic regions, Law of Mass Action, p-n junction, Transistor.

#### **Waves and Oscillations**

Simple harmonic oscillator, damped harmonic oscillation, forced oscillation and response, type of waves and superposition principle, wave speed on a stretched string.

#### **Optics and Lasers**

Huygen's principle, Two-slit interference, -single-slit diffraction, resolving power of optical instruments, principals for laser action, types of laser, applications of laser.

#### **Modern Physics**

Planck's explanations of black body radiation, Photoelectric effect, Compton effect, Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis, Electron microscope, Atomic Nucleus and Properties of Nucleus, Radioactive Decay and Radioactive Dating, Radiation Detection Instruments, Nuclear Reactions and Nuclear Reactor.

### **AU-113 INTRODUCTION TO AUTOMOTIVE SYSTEMS**

#### **Introduction:**

Definition of automobiles; Classifications of automobiles: based on wheels, based on intended use; national and international classifications; Historical development: From basic carriages to modern vehicles, Growth and refinements.

#### **Engines:**

Types of engines: Spark ignition engines, Compression ignition engines, Two and four stroke engines; Arrangement and functions of the main components of the engine: Cylinder head assembly, Cylinder block assembly, Intake and exhaust, Turbo charger / Super chargers, Valves.

#### **Fuel Delivery System:**

Basic principles and operations of fuel delivery system, Carburetor system, Electronic fuel injection (EFI) system, Fuel pump and filter, Fuel tanks and piping.

#### **Lubrication system:**

Basic purpose of lubrication, Elements of lubrication system: Types of bearings and their function, Lubricants types and selection for optimal use.

#### **Cooling system:**

Elements of cooling system: Coolants and additives, Water pump, Radiators, Fan and shroud, Hoses.

#### **Transmission and Drivelines:**

Functions and configurations of transmission and drives, Elements of drive train: Friction clutches, Gear theory and types, Manual transmissions, Automatic transmissions, Continuously Variable Transmission (CVT), Drive shafts, Transmission case, Four / All wheel drives.

### **Steering system:**

Classification of steering systems: Worm and wheel, Rack and pinion, Power steering. Steering Dynamics, Vehicle rollover, Steering geometry.

### **Suspension system:**

Classification of suspension systems: Solid axle, Independent, Macpherson struts; Suspension system components: Leaf springs, Coil springs, Torsion bars, Pneumatic springs, Dampers / Shock absorbers; Suspension roll center analysis.

### **Brakes and Tires:**

Introduction of braking systems, braking dynamics, Types of brakes: Mechanical brakes, Hydraulic brakes, Anti-locking Braking System (ABS), Traction Control System (TCS); Tires: Types / Construction, Tire designation, Tire force and tire wear; Wheels: Steel wheel and rims, Alloy wheels; Wheel balancing.

### **Automotive Bodies And Chassis:**

Body structure, Body materials, Body finishing, chassis Types, Automotive glasses, Body locking systems, Safety parameters crash tests.

### **Overview of the Automotive Industry:**

Issues faced by the industry: Fuel prices, Emissions, Safety. Stake holders in the automotive industry, Global automotive industry, Regional automotive industry, National automotive industry, and SWOT analysis.

## **HS-104 FUNCTIONAL ENGLISH**

### **Listening**

- a. Types of Listening
- b. Problems in listening and coping strategies
- c. Listening skills, Sub skills
- d. Practice in Listening

### **Note taking**

- a. Techniques for taking notes (from lectures, from books)
- b. Note taking in different forms paragraphs (points, figures, processes, tables, graphs etc.)

### **Vocabulary development**

- a. Enhancing current vocabulary to reflect a better usage of words in spoken and written language
- b. Tips / strategies in vocabulary enhancement
- c. Practice in vocabulary development

### **Reading**

- a. Reading skills, Sub skills
- b. Reading comprehension levels
- c. Reading strategies
- d. Reading practice through variety of reading texts and comprehension exercises
- e. Beyond reading [outline, précis, speech and presentation]

### **Writing**

- a. Process of Writing
- b. Informal Writing strategies

### **Writing Correctly**

- a. Sentence structure and punctuation
- b. Error correction

### **Paragraphs**

- a. Structure
- b. Types
- c. Topic and the topic sentence
- d. Unity

- e. Adequate development and coherence in paragraphs

### Essays

- a. Types
- b. Five paragraphs, long essays
- c. Structure (thesis statement and the paragraphs)

### Short Reports

- a. Structure
- b. Format and types (informational and analytical)

### Letters

- a. Elements, Styles
- b. Formatting (digital letter writing)
- c. Organization and structure of the letter
- d. Types (Routine requests and intimation, invitation, thank you and condolence letters etc.)

## **MT-114 CALCULUS**

### Set and Functions

Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; 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.

### 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 Hopitals 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.

### Sequence & Series:

Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

### Complex Number

Arganddiagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

## **HS-105 PAKISTAN STUDIES**

### **Chapter-1) Historical and ideological perspective of Pakistan Movement**

#### 1. 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.

#### 2. Creation of Pakistan

- Factors leading to the creation of Pakistan.
- Quaid-e-Azam and the demand of Pakistan.

### **Chapter-2) Land of Pakistan**

- Geo-physical conditions

- Geo-political and strategic importance of Pakistan.
- Natural resource, viz: mineral, water and power.

### **Chapter-3) Constitutional Process**

- Early efforts to make a constitution (1947-1956) problems and issues.
- Salient features of the constitution of 1956 and its abrogation.
- Salient features of the constitution of 1962 and its abrogation.
- Constitutional and political crisis of 1971.
- Salient features of the constitution of 1973
- Constitutional developments since 1973 to date with special reference to the amendments to the constitutions.

### **Chapter-4) 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.

### **Chapter-5) Pakistan's Foreign Policies**

- Evolution of Pakistan foreign policy-1947 to date
- A brief survey of Relation with Neighbours, Super Powers & the Muslim World.

### **Chapter-6) Human Rights**

#### **Conceptual foundations of Human Rights**

- What are Human Rights? Definition, origins & significance.
- Comparative analysis of Islamic and Western Perspectives 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)**

### **Chapter 1 – Land of Pakistan**

- Land & People–Physical features and demography
- Geographical and strategic importance of Pakistan
- Natural resources–Mineral, water, and power
- Natural Landscape
- Environmental issues in Pakistan
- Cultural heritage: important remnants of ancient civilizations in Pakistan

### **Chapter 2 – Creation of Pakistan**

- A brief Historical survey of Muslim community in the sub-continent
- Two-Nation theory–its origin & development
- Rationale for Pakistan–Factors leading to the demand of Pakistan
- Emergence of Pakistan
- Role of Quaid-e-Azam the struggle for Pakistan

### **Chapter 3 – Government & Politics in Pakistan**

- Political History of Pakistan–A brief account (1947 to date)
- Constitution of Pakistan 1973–Salient features
- Governmental structure–Federal, Provincial and Local

### **Chapter 4 – Pakistan in the Community of Nations**

- An overview of Pakistan’s foreign policy
- Relations of Pakistan with neighbors, Super Powers, and the Muslim World

### **Chapter 5 – Pakistan’s Stand Point on Human Rights**

- Constitutional provisions
- Comparative analysis of Western and Islamic perspective of Human Rights
- Pakistan’s Stand on national and international level

## **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.

## **SPRING SEMESTER**

### **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 Cable**

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.

## **ME-112 THERMODYNAMICS**

### **Thermodynamic Properties:**

Introduction; working substance; system; pure substance; PVT surface; phases; properties and state; units; zeroeth law; processes and cycles; conservation of mass.

### **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 rules; 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.

## **AU-112 ENGINEERING DRAWING AND COMPUTER GRAPHICS**

### **Engineering Drawing:**

Drawing equipment and the use of instruments; basic drafting techniques and standards; freehand sketching of machine and engine components; geometrical curves including plane curves: cycloid, hypocycloid, and the involutes.

Intersections and development of surfaces of geometrical bodies such as prism, pyramids, cylinders and cones.

Concept of working drawing of component parts of machines and engines: size, description, dimensions, and specification; limit dimensioning and geometric tolerances; limits; fits and tolerances; conventional symbols.

### **Computer Aided Graphics:**

Introduction, application of computers in drafting and designing, methods for creating drawing entities, common editing features, dimensioning with variable setting, printing and plotting.

The Software configuration of a graphics system; functions of a graphics package; constructing the geometry; Introduction to wire framing and solid modelling.

## **EE-118 BASIC ELECTRICITY & ELECTRONICS**

### **DC Analysis:**

Series and Parallel electric circuits: Kirchhoff's voltage law(KVL) and Kirchhoff's current law (KCL), voltage divider and current divider rules; series parallel circuits; Y-Delta conversions; methods of circuits analysis: mesh analysis and nodal analysis; network theorems: superposition, Thevenin's Norton and maximum power transfer; Magnetic circuits: magnetic fields, flux density, permeability, reluctance, magnetizing force, hysteresis, Ampere's Circuital law; capacitors and inductors: electric field and dielectric strength; charging and discharging phase of capacitor; capacitor types; faraday's law of electromagnetic induction; Lenz's Law; charging and discharging phase of an inductor.

### **AC Analysis and Poly Phase Systems:**

General format of sinusoidal voltage and current; phase relations; average power and power factor, frequency response of basic elements(R, L,C);rectangular and polar form conversions; series-parallel circuits with phase or diagrams; mesh analysis and nodal analysis; Network theorems; passive filters: low pass, high pass, pass band, stop band filters, resonance: series resonant and parallel resonant circuits, poly phase systems.

### **Electrical Machines:**

Introduction to electrical Machines; Transformer: basic construction, operation and types; DC Motors and Generators: construction of DC motors and generators, working principles, equivalent circuits, losses and efficiency calculations; A motors and generators: construction of AC motors and generators, working principles, Equivalent circuits, losses and efficiency calculations, power and torque curves in generators.

### **Basic Electronics:**

Introduction to Electronic Engineering; P-N junction: Semiconductor theory, dopings and energy bands, diode models, diode data sheet understanding, diode applications (half wave, full wave and bridge rectifier, clipper and clamper); BJT and FET construction, operation and characteristics curves, Introduction to Digital Electronics; Comparison with Analogue electronics.

## **CY-109 APPLIED CHEMISTRY**

### **Gases:**

kinetic gas equation; vander Waal's equation; critical phenomenon; liquidification of gases; specific heat (molar heat capacity).

### **Properties of Solutions & Liquids:**

Surface tension, viscosity, osmosis, osmotic pressure, ph-buffer solution, spectrophotometer, basic concepts of colloidal chemistry, classification purification (dialysis).

### **Thermo-Chemistry:**

Chemical Thermodynamics, Hess's law, heat of reaction, relation between h and u, measurement of heat of reaction, bomb calorimeter.

### **Electrochemistry:**

Laws of electrolysis, E.M.F. series, corrosion (theories, inhibition & protection);

### **Water & Sewage:**

impurities, hardness, water softening, purification of water for potable and industrial purposes, introduction to environmental pollution, sewage treatment.

### **Fuels:**

Types of fuels, classification, calorific value.

### **Metals & Alloys:**

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

**Engineering Materials:**

Inorganic engineering materials: cement, glass; organic engineering materials: polymers, rubbers, plastics and paints; semiconductors and dielectric materials.