

## **SECOND YEAR** **FALL SEMESTER**

### **AU-201 AUTOMOTIVE POWER PLANTS**

#### **Introduction:**

Introduction to four stroke spark and compression ignition engines; speed and load control in SI and CI engines; two stroke engines; supercharging.

#### **Cycles:**

Idealized cycle and processes: diesel cycle, Otto cycle, dual cycle; regenerative cycle; volumetric efficiency, pumping losses, scavenging. Engine friction. Heat transfer and Engine valve timing diagram.

#### **Power measurement:**

Measurement of engine torque and power, dynamometer principle; measurement of brake and indicated horse power; use of indicator diagram.

#### **Systems:**

Fuel systems; petroleum and non-petroleum fuels; characteristics of SI and CI engine fuels; LPG and CNG as IC engine fuel; Octane and Cetane number; lubrication systems and lubricants; Working of carburettor; gasoline and CI injection systems; CI engine nozzles.

#### **Characteristics:**

Performance characteristics of SI and CI engines.

#### **Unconventional prime movers:**

Introduction to Fuel cells; fuel cell and 2<sup>nd</sup> law of thermodynamics; types of fuel cell and their application in automobiles; limitations of fuel cells; Introduction to Stirling engines and hybrid power plants for automobiles.

### **AU-212 COMPUTER PROGRAMMING AND APPLICATION**

#### **Introduction to Computer:**

What is computer? Parts, Hardware, Software, data and people. Differences between super, mainframe, personal computers and work stations. Operating system types and comparison of current operating systems. Introduction to database and knowledge of the fundamental concepts of DBMS and its application in different areas, storage, manipulation and retrieval of data. Introduction to parallel processing as well as clusters.

#### **Data Processing and Networking:**

Transforming data into information, how computers represent and process data, Number System. Networking basics, types of networks, network topologies, networking protocols and network media.

#### **Introduction to Programming:**

Programming Environment: Introduction to Computer Languages, Difference between high, low and machine level language, Compiler and interpreter, Steps to prepare a program, pseudo code, and flow chart.

Variables & Data types: Concept of variables, constants and data types. Different data types used in programming language such as integer, float, character, string etc.

Operators and Expressions: Arithmetic, Unary, Relational and Logical operators, Assignment and Conditional operator

Looping: For loop, while loop, do while loop

Decisions: If statements, else-if construct, switch statement, break and continue statement

Functions or Procedures: Defining and accessing a function, passing arguments and returning values to functions, and pre-processor directives

Arrays & Strings: Defining and referring to individual elements of an array, passing arrays to a function, multidimensional arrays. String constants and variables, String I/O functions and Array of strings.

### **Computer Application in Engineering:**

Introduction to Computer Aided Engineering (CAE). Effective use of CAE to solve real world engineering problems, including plotting, model building, statistical and mathematical tools. Awareness of dedicated softwares used in different engineering applications.

## **AU-225 FUNDAMENTALS OF ANALOGUE AND DIGITAL ELECTRONICS**

### **Analogue Electronic:**

**Amplifiers:** Introduction to Amplifier, amplifier properties, configurations and classifications; BJT based amplifiers: common base, common emitter, common collector, differential and multistage configuration; FET based amplifiers: Common source, common gate, common drain configurations; operational amplifiers and their applications.

**Regulators:** Introduction to regulators voltage regulators (series & shunt), regulator ICs.

**Oscillators:** introduction to Oscillators: phase shift and crystal controlled oscillators; **thyristors and**

**Optoelectronic devices :** Introduction to optoelectronic devices: LEDs, LCDs, and photo diodes, phototransistor, introduction to thyristor: silicon controlled rectifier (SCR), diacs, triacs and their applications.

### **Digital Electronics:**

**Logic Gates:** Universality of NAND and NOR gates; SOP and POS forms and simplifications; BCD code and parity method for error detection;

**Integrated Circuit Logic Families:** Digital IC terminology; (current & voltage parameters, propagation delay, speed-power product); TTL and CMOS logic family and IC data sheets understanding; decoders; BCD to 7-segment decoders/drivers; encoder; multiplexer and demultiplexer with their applications; Converters: specifications; interfacing with analogue world; Analog-to-digital and digital-to-analog converters; ADC & DAC data sheet understanding.

## **MT-223 ORDINARY DIFFERENTIAL EQUATIONS & FOURIER SERIES**

### **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 2nd 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.

### **Partial Differential Equation**

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

### **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 nth order derivative, initial and final value theorem Laplace transform of integrals. Laplace transform of functions  $f(t)$  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.

### **Fourier series**

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

## **ME-209 MATERIALS & METALLURGY**

### **Introduction to Materials Engineering**

Types of materials, Source of materials and their extraction, Crystalline and amorphous materials, Application and selection of materials (basic criteria for different environments).

### **Metallic Materials**

Pure metals and alloys, Nature and properties of metals and alloys, Major properties of metal and alloys, Single crystal and polycrystalline metals, Crystal defects and the mechanism of deformation and fracture, Plastic flow in polycrystalline materials, Structure property relationship, Macro and micro examination, Structural aspect of solidification and solid phase transformation in binary systems, Ferrous and non-ferrous metals, steel making processes, Heat treatments, TTT diagram, Surface hardening coatings, Powder Metallurgy, Nondestructive testing.

### **Ceramics, Glasses and Refractory Materials**

Compositions, Properties, Structures of various non-metallic materials, Application of ceramics, Glasses, Refractory materials, Methods of manufacture.

### **Polymers and Rubbers**

Polymerization, Structural feature of polymers, Thermoplastic polymers, Thermo setting polymers, Additives, Major mechanical properties, Rubber (Elastomers), Synthesis of rubber.

### **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 atmosphere, Aqueous and galvanic corrosion, Stress corrosion cracking, Methods of Corrosion prevention, Behavior of metal at elevated temperature pyrometer, Oxidation, Scaling and creep, Chemical degradation of ceramic and polymers, Radiation damage of surface, Improvement against Degradation.

## **AU-203 STATISTICS & QUALITY CONTROL**

### **Fundamentals of Probability and Statistics:**

Elementary probability; data collection, grouping; statistical features of data; discrete and continuous variables; expectation and its laws. Probability distributions: the binomial, multinomial, hyper-geometric and Poisson; continuous distributions: normal and exponential distributions; sampling plans; use of computer programs in solving statistical problems

### **Control Charts and Acceptance Sampling:**

Properties of the distribution of sample means; sample range estimation of standard deviation; chance and assignable causes; control charts for mean and standard deviations; control charts for proportion defective and defects per assembly. Test of significance to compute confidence limits; Single, double and multiple sampling; use of relevant computer software

### **TQM:**

KAIZAN; process capability; ISO 9000; use of applicable computer software.

## **SPRING SEMESTER**

### **ME 213 DYNAMICS**

#### **Kinematics of Particles**

Rectilinear and curvilinear motion of particles, Rectangular, Tangential, Normal, Radial and transverse components of velocity and acceleration, Motion relative to a frame in translation.

#### **Kinetics of Particles**

Force, Mass and acceleration, Newton's second law, Dynamic equilibrium, Rectilinear and curvilinear motion, Work and energy, Kinetic energy of a particle, Principle of work and energy, Conservation of energy, Impulse and momentum, Impulsive forces and conservation of momentum, Impact, direct and oblique, Angular momentum of particle and a system of particles, Conservation of angular momentum, Variable systems of particles, Systems gaining or losing mass.

#### **Kinematics of Rigid Bodies**

Translation, Rotation about fixed axis, General plane motion, Absolute and relative velocity and acceleration.

#### **Plane Motion of Rigid Bodies**

Forces, Acceleration, Energy and momentum, Conservation of linear and angular momentum.

#### **Kinetics of Rigid Bodies in Three Dimensions**

Equations of motion of a rigid body about a fixed point, About its mass center or about a fixed axis, Gyroscopic motion.

### **ME -202 SOLID MECHANICS-I**

#### **Statically Determinate Frames and Beams**

Free body diagrams; Determination of forces in frames; Shear force and bending moment diagrams; Relationship between loading shear force and bending moment.

#### **Statically Determinate Stress Systems**

Stress; Direct, shear, hydrostatic and complementary shear stresses; Bar and strut or column: Thin ring or cylinder rotating; Stresses in thin shells due to pressure or self-weight.

#### **Stress-Strain Relation**

Deformation; Strain; Elastic stress-strain behavior of Materials; Lateral strain and Poisson's ratio; Thermal stress and strain; General stress-strain relationships

#### **Statically Indeterminate Stress Systems:**

Interaction of different materials, Interaction of different stiffness components, Restraint of thermal strain; Volume Changes; Constrained materials.

#### **Bending Stresses**

Simple bending theory; General case of bending; Composite Beams; Eccentric end load; Shear stresses in bending.

#### **Bending: Slope and Deflection**

Deflection curve of the neutral axis; Double Integration and Super-position methods.

#### **Theory of Torsion**

Torsion of thin-walled cylinder; Torsion of a solid circular shaft; Hollow shafts, Non-uniform and composite shafts, tapered shaft, torsion of thin rectangular strip; torsion in helical springs.

#### **Theory of Columns**

Euler's theory of buckling; Eccentric loading of long columns. Behaviour of ideal and real struts. Struts with initial curvature; Crinkling; Members subjected to axial and transverse loading.

### **AU-231 MANUFACTURING ENGINEERING-I**

#### **Casting**

Sand casting; Material types and construction of pattern; Moulding materials and processes; Moulding Machines and equipments; Testing of sand; development of core and its types, Shell moulding, Plaster moulding,

Centrifugal casting, pressure die-casting, Vacuum die casting, Hot chamber and cold chamber methods of die-casting, Material selection, trimming and finishing operations; Inspection of casting

### **Injection Moulds**

Standard mould base selection, types of mould, Blow moulds, Compression moulds, Transfer moulding, Vacuum forming, Single and multi cavity moulds, Runner and riser types, Gates and their types, Gate location and dimensions, Cooling systems, Alternate cooling systems, Heating systems, Ejection system, Surface finish, Draft angle and its importance, Venting, problems and trouble shooting.

### **Metal Forming**

**Hot working processes:** Fundamentals of Hot working processes, Rolling, Rolling mills, Open die hammer forging, Die drop forging, Press forging, upset forging, Roll forging, near net shape forging, extrusion, Extrusion methods, Extrusion of hollow shapes, Hot drawing, hot spinning, Pipe welding and piercing.

**Cold working processes:** Squeezing, Shearing processes such as rolling, extrusion, sizing, riveting, burnishing, thread rolling, angle bending, roll bending, roll forming, seaming, straightening, bar and tube drawing, wire drawing and stretch forming.

### **Welding**

Classification of welding processes; Oxyacetylene welding, Oxygen torch cutting, 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, Power sources for arc welding. Arc cutting; Resistance welding; Heating, pressure, Current control & Power supply, Spot welding, Seam welding, Projection welding; Other welding processes; Forge welding, Roll welding, Friction welding, Explosion welding, Thermic welding, Electron beam welding, Laser welding & cutting, Brazing & Soldering.

### **Machining Operations:**

Machine tools using single and multiple point tools: Description, Functions, Operations performed on Shaper, Planer, Boring machines, Work holding devices, Drilling, Milling, Gear cutting, Broaching machines.

Machine tools using abrasive wheels; description, functions, various types of grinding machines and operations, Wheel dressing, Wheel balancing; Honing, Lapping and super finishing operations.

Nontraditional machining processes; EDM, EDM wirecut, ECM & Ultrasonic machining.

## **AU-222 AUTOMOBILE INSTRUMENTATION**

### **Introduction:**

What is instrumentation; instrumentation types and applications.

### **Electronic Testing Meters:**

(Analog /digital) voltmeters, ammeters, ohmmeter and other multimeter functions, logic analyzers, measurement error handling.

### **Sensors and Transducers:**

Measurement system classification (by function, by performance, by outputs), transducer technology (solid state, optical, piezoelectric, ultrasonic), transducers (resistive, capacitive, inductive), optical measurement system (photo detectors, fiber optic); Automobile air flow rate sensor, engine crankshaft angular position sensor, typical coolant sensor

### **Solid State Sensors and Transducers:**

Magnetic measurement, temperature measurement, mechanical measurement (force, pressure, velocity, speed, position, stress, strain and fluid flow measurement).

### **Recorders:**

Analogue & digital recorders with their applications.

### **Actuators:**

Solenoids & relays, electric motors and hydraulics; automobile fuel injection, exhaust gas circulation actuators, digital engine control system.

### **Basics of Electronic Engine Control:**

Engine performance terms (power, BSFC, torque, volumetric & thermal efficiency, air/fuel ratio, spark timing); electronic fuel control system, and electronic ignition.

### **Vehicle Motion Control:**

Typical cruise control system, antilock braking system, electronic suspension system, and electronic steering system.

### **Display Devices:**

Light-emitting diode (LED), liquid crystal display (LCD), vacuumed fluorescent display (VFD), cathode ray tube (CRT)

Introduction to intelligent vehicle control system: intelligent vehicle sensor technologies (the CAN bus), global positioning technology in the intelligent transportation space, radio communication technology for vehicle information system.

## **ME -204 FLUID MECHANICS-I**

### **Properties of Liquids and Gas:**

Ideal and real fluids; properties and gases; viscosity and compressibility of fluids; fluid pressure.

### **Fluid Statics (Equilibrium):**

Euler's conditions of equilibrium; pressure in a fluid under the action of gravity. homogeneous fluid; several fluids of different specific weights; interconnected vessels; constant-velocity rotation of a liquid around-fixed axis; fluid under pressure neglecting gravity; force on container wall; force on flat surfaces: force on curved surfaces; buoyancy of fluid at rest; stability of a floating body; surface tension and capillary tubes; atmospheric equilibrium; isothermal state; adiabatic state; the standard atmosphere.

### **Fluid Dynamics:**

One dimensional in-viscid flow (flow filament theory); equation of continuity; Euler's equations of motion; Bernoulli's equation; impulse and momentum. one dimensional viscous flow; generalized Bernoulli's equation; laminar and turbulent flow in circular pipes; pipe flow problems; flow in open channels.

### **Dimensional Analysis:**

Buckingham- Pi theorem; Reynolds' law of similitude.

### **Fluid Measurements:**

Measurement of static pressure; Stagnation pressure, flow velocity and flow rate.

## **HS-205 ISLAMIC STUDIES**

### **SECTION – A: Quranic Verses**

#### **Chapter 01**

- **Tauheed:** Al-Ambiya-22, Al – Baqarah-163&164.
- **Prophet Hood:** Al-Imran-79, Al – Huda-7,Al-Maida0h-3.
- **Here-After:** Al – Baqarah-48, and one Hadith.

#### **Chapter 02**

- **Basic Islamic Practices:** Al – Mu' minun-1-11, and two Ahadith

#### **Chapter 03**

- **Amer-Bil-Ma'Roof Wa-Nahi Anil Munkar:**
  - the concept of Good & Evil,
  - Importance and necessity of Da'wat-e-Deen Al-Imran – 110
  - Method of Da'wat-e-Deen An-Nehl-125, Al-Imran-104, and two Ahadith

#### **Chapter 04**

- **Unity of the Ummah:** Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An' am –108, and two Ahadith.

#### **Chapter 05**

- **Kasb-e -Halal:** Ta ha-81, Al-A'raf-32-33, Al-Baqarah-188, and two Ahadith.

#### **Chapter 06**

- **Haquq-ul-Ibad:** Protection of life Al-Maidah-32
  - Right to Property Al-Nisa-29
  - Right to Respect & Dignity Al-Hujurat -11-12

- Freedom of Expression: Al-Baqarah-256
- Equality: Al-Hujurat-13
- Economic Security: Al-Ma'arj-24-25
- Employment Opportunity on Merit: An-Nisa-58
- Access to Justice: An- Nisa-135

#### Chapter 07

- **Women's Rights:** An-Nehl-97, Al-Ahzab-35, An-Nisa -07

#### Chapter 08

- **Relations with Non-Muslims:** Al-Mumtahanah-8-9, Al-Anfa'al-61 and The last Sermon of Hajj of Holy Prophet (PBUH): Relevant extracts

### **SECTION B:**

#### Chapter 09

- **Seerat (Life) of the Holy Prophet (PBUH):**
  - Birth
  - Life at Makkah
  - Declaration of prophet hood
  - Preaching & its difficulties
  - Migration to Madina
  - Brotherhood (Mawakhat) & Madina Charter
  - The Holy Wars of the Prophet (Ghazwat-e -Nabawi)
  - Hujjat-ul -Wida
  - The last sermon of Khutbatulwida Translation and important points

### **SECTION C:**

#### Chapter 10

- **Islamic Civilization:**
  - In the sub continent: pre-Islamic civilizations. The political, social & moral impacts of Islamic civilization.
  - In the world: academic, intellectual, social & cultural impact of Islam on the world.

## **HS-209 ETHICAL BEHAVIOUR**

### Introduction to Ethics:

- Definition of Ethics
- Definition between normative and positive science
- Problem of freewill
- Method of Ethics
- Uses of Ethics

### Ethical Theories:

- History of Ethics: Greek Ethics, Medieval, Modern Ethics
- Basic concept of right and wrong: good and evil
- Utilitarianism, hedonism, self-realization: egoism, intuitionism, rationalism
- Kant's moral philosophy

### Ethics & Religion:

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

### Ethics, Society, and moral theory:

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