# **Course Contents**

# GS-101 Math-I Calculus and Analytical Geometry (3, 0)

Introduction to functions, introduction to limit, derivatives and their applications, integral calculus with applications, vector algebra, vector calculus, introduction to analytical geometry, straight line in R3, planes, cylindrical and spherical coordinates, surfaces, cylinders and cones, spheres, spherical trigonometry.

#### **Recommended Books:**

- 1. Calculus and analytical Geometry, **11th Edition** By Thomas Finney John Wiley & Sons
- 2. Advanced Engineering Mathematics, 5th Edition By C. R. Wylie McGraw-Hill Education
- Advanced Engineering Mathematics, 8th Edition By HTErwin KreyszigTH John Wiley & Sons

# **GS-102** Applied Physics (2,0)

Introduction: Scientific notation and significant figures. Units in different systems. Vectors: Review of vectors, Vector derivatives, Line and surface integrals, Gradient of scalar. **Mechanics:** Coordinate systems. Motion under constant acceleration, Newton laws and their applications, Uniform circular motion. Vortex Motion, Frictional forces. Work and energy. Potential energy, energy conservation, energy and our environment. Electrostatics and magnetism: Coulombs law. Gauss's law. Electric field around conductors. Dielectrics. Magnetic fields. Magnetic force on current. Semiconductor Physics: Energy levels in a semiconductor. Hole concept. Intrinsic and extrinsic regions. Law of mass action. P-N junction. Transistor. **Waves and Oscillations:** Free oscillation of systems with one degree of freedom. Classical wave equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. **Optics and Laser:** Basic introduction to Optics and Laser. Diffraction grating. Lasers, population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO2 lasers. Doppler Effect and sonic boom. Modern Physics: Photoelectric effect, Compton Effect. Bohr theory of hydrogen atom, atomic spectra, reduce mass, De-broglie hypothesis braggs law, electron microscope, zeeman effect, atomic nucleus, mass energy relation, binding energy, nuclear forces and fundamental forces. Exponential decay and halflife.

# **GS-103 Applied Chemistry (2,0)**

**Physical Chemistry**: Properties of various groups and periods of periodic table. Sources, production and uses of the major chemicals with relevance to Pakistan. **Thermo-chemistry**: Chemical Thermodynamics, Hess's Law, heat of formation and reaction, relation between H and U, measurement of heat reaction, Bomb calorimeter **Electrochemistry**: Laws of electrolysis, E.M.F. Series, corrosion (Theories, inhibition & protection), batteries. **Industrial Chemistry**: Industrial chemistry introduction, Manufacture and uses of various hydrocarbons. Lubricants and oils. Production and application of paints, rubbers and fuels. Environmental pollution and control. **Water Treatment Methods**: Water softening, treatment of water for industrial purposes.

# EN- 101 Functional English (3,0)

#### **Specific Objective:**

To enhance language skills and develop critical thinking

## **Course Outline:**

#### 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.

## **Recommended Books:**

- a) Grammar
  - 1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
  - Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
  - 3. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
- b) Reading/Comprehension
  - 1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402
- c) Speaking

# CS-101 Computer System and Programming (2,1)

#### **Specific Objectives:**

- □ To learn fundamentals of computer hardware and basic terminologies.
- $\Box$  To learn structure programming to solve the engineering problems.

## **Course Outline:**

**Introduction to Computers.** Computer components and systems, Networks, Operating Systems. Input/output devices, CPU, Primary and secondary storage devices.

**Software:** Word Processing, Spreadsheets, Presentation software, Internet Browsers & E-mail.

Introduction to Programming. Flowcharts, Pseudo codes, logical gates.

## Lab Outline:

**Programming in C++.** Structural Programming, logical and mathematical operators, loops, conditional statements, arrays, functions.

## **Recommended Books:**

- 1. Turbo C, By Robert Lafore
- 2. Programming with C++, Schaum's Series 3. Turbo C, By Deitel & Deite

# **ME-111 ENGINEERING DRAWING AND GRAPHICS (2,1)**

## Specific Objectives:

- To inculcate in students the ability to comprehend the science of Engineering Drawing so that they are able to convey their creative ideas effectively.
- To provide the link from conventional 2D drawings.

**Introduction.** Types of lines, lettering, dimensioning, use of pencil and drawing instruments, planning of drawing sheet.

**Projections.** Types of projections, orthographic projections, plane of projections, four quadrants, projection of points, projection of straight lines, examples with different quadrants, traces of a line, true length of a line, inclination to both the planes, projection of oblique and auxiliary planes.

Loci of Points and Generated Curves. Loci of points and straight lines. Cycloid, epicycloid, involute, archemedian spiral.

**Development of Solids**. Types of solids, polyhedra, solids of revolution, prism, pyramid, cylinder, cone, sphere.

**Intersection of Surfaces**. Intersection of cylinder and cylinder, cone and cylinder, cone and prism.

**Projection of Solids**. Projection of various solids in simple position and inclined positions.

Section of Solids. True shape of section on auxiliary plane of various solids.

## Lab Outline:

Isometric and pictorial projections of solids/machine parts, making of freehand sketches from solid objects and from orthographic projections. Sections of joints, screw thread systems, nuts and bolts, keys and cotter, coupling and bearings.

## Recommended Books:

- 1. Technical Graphics Communication By Bertoline Wiebe, Miller. Mohler, Irwin McGraw-Hill
- Practical Geometry & Engineering Graphics By Abbot. 3.
   Engineering Graphics By Craft, Meyers & Boyer
- 4. Technical Graphics Communication, *By Gary R. Bertoline and Eric N. Wiebe*; McGraw-Hill
- 5. Mathematical Elements for Computer Graphics *By D. F. Rogers and J. A. Adams*; McGraw-Hill

# **GS-104 Math-II Linear Algebra and Ordinary Differential** Equations (3,0)

## **Course Outline:**

First Order and Second Order Differential Equations and Their Solutions, Series Limit, Theorems for Calculating Limits of Sequences, Infinite Series, Integral Test for Series, Absolute and Conditional Convergence, Power Series, Taylor and Maclaurin Series, Convergence of Taylor Series, Vector Calculus, Parameterization of Plane Curves, Lines and Planes in Space, Function of Several Variables, Partial Derivative, Equation of Tangent Planes and Parameterization of Normal Lines, Curl, Gradient, Divergence, Laplacian, 3-D Geometry, Conics.

## **Recommended Books:**

- 1. Calculus and analytical Geometry, 11th Edition By Thomas Finney John Wiley & Sons
- 2. Advanced Engineering Mathematics, **5th Edition** By C. R. Wylie McGraw-Hill Education
- Advanced Engineering Mathematics, 8th Edition By HTErwin KreyszigTH John Wiley & Sons

# **EE-101 Electrical Engineering (2,1)**

## Course Outline:

#### **Electric and Magnetic Circuits**

Electric circuits, Kirchoff's laws, Superposition theorem, Substitution theorem. Thevenin's theorem, Norton's theorem, Rosen's theorem of star / mesh transformation, Proof for DC circuits and their application to circuit analysis, Magnetic circuit, Series and parallel circuits, Principles of calculation of ampere turns for magnetic circuits of electromagnets, Transformers, Bipolar and multipolar DC machines Inductances in series and parallel, Hysteretis loss, Eddy current loss, Lifting power of mange

#### AC Single phase and Polyphase Systems

Single-Phase systems, Series, Parallel and series parallel circuits, J operator method and polar method.Resonance and measurement of power and power factor, Polyphase systems, Polyphase generation, Star and delta connections, Voltage and current relations, Measurement of power and power factor, Balanced and unbalanced load analysis.

#### DC Machines

Construction: Simple lap and wave windings, Equalizing connections and dummy coils, Elementary concept of armature reaction and commutation, Cross and demagnetizing ampere turns, DC generator, Types, EMF equation, Losses, Efficiency, Performance curves, Characteristics, Critical resistance and speed and effect of armature reaction of OCC, Internal and external characteristics from OCC neglecting and accounting armature reaction, Calculation of series ampere turns for level and over compounding. Motors, Principle, Back EMF, Torque, Speed and speed regulation, Types, Characteristics, Performance curves, Losses and efficiency, Speed and torque problems involving magnetization curve, Charging and ignition circuits of automobiles.

#### AC Synchronous Machine

Construction: Stator single layer, Double layer and concentric windings, Damping windings, Coil span factor, Distribution factor, Leakage and armature reaction, Synchronous impedance, Alternators, Types, EMF equation, Speed and frequency, Losses and efficiency, Alternator on load voltage regulation by synchronous impedance method, Synchronous Motors, Types, Principle of working, Vector diagram on load and its analysis for stator current, Power factor, Torque and mechanical output, Effect of variation of excitation, Losses and efficiency.

#### AC Induction Machines

Induction Motors, Construction, Types, Rotating field theory, Principle of working, Slip and its effect on motor current quantities, Losses, efficiency and performance curves, Starting, Full load and maximum torque relations, Torque slip characteristics.

#### 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 and Kapp's regulation diagram, Transformer as a mutually inductive circuit.

#### Converting Machines

Rotary converters: Construction, Principle of working, Transformer connections, Voltage and current ratios of single and three phase converters, Mercury arc rectifiers, Construction, Operation, Transformer connections, Voltage and current ratios of single phase and three phase rectifiers.

# ME-121 THERMODYNAMICS-I (3,0)

#### Specific Objectives:

- To gain basic concepts of thermodynamics and its laws, conservation of energy and cycle concepts.
- Properties of working fluids.

## Course Outline:

**Basic concepts:** the system, control volume, working substance, heat and work, state and properties, thermodynamic process and cycle, first law of thermodynamics, ideal gas laws, equations of state, thermodynamic temperature scale, concept of open and closed cycles

**Properties of pure substances:** phase diagram, use of steam tables.

**Thermodynamic processes relationship**: constant volume, constant pressure, constant temperature, constant enthalpy and general law processes, steady state and steady flow process, uniform state and uniform flow processes, steady flow energy equation and steady flow devices.

**Second law of thermodynamics:** definitions, applications, reversible and irreversible processes, Carnot cycle and concept of entropy and its application to flow and non-flow processes, enthalpy-entropy diagrams of working fluids, thermodynamic cycles, efficiencies, and their applications, Idealized P-V and T-S diagrams of cycles, Rankine cycle and its application.

## Lab Outline:

The experiments of Thermodynamics-I will be conducted with Thermodynamics-II.

## Recommended Books:

- 1. Thermodynamics, An Engineering Approach, By Yunus A. Cengel, Michael A. Boles McGraw-Hill
- 2. Fundamentals of Engineering Thermodynamics, *By M. J. Moran and H.O. Shapiro,* John Wiley & Sons
- 3. Fundamentals of Thermodynamics, By Sonntang, Borgnakke, Van Wylen John Wiley &

Sons

4. Applied Thermodynamics for Engineering Technologists, By T. D. Eastop and A. McConkey

# **ME-112 WORKSHOP PRACTICE (0,2)**

## Course Outline:

## **Specific Objectives:**

- To learn the basic operations of Machine, Fitting, Electric, Carpentry
- Smithy shops.

To get hands on experience on various machines.

• To learn the use various tools.

## Lab Outline:

**Fitting Shop.** Assembly/disassembly of basic mechanical components.

**Wood-Work Shop.** Timber and its type, defects, and preservation methods, different types of wood joints.

**Electric Shop.** Types and uses of cables. Types of electric circuits, electrical appliances.

Forging & Foundry Shop. Tools and accessories, furnace types, casting. Machine Shop. Introduction to machine tools, basic lathe operations. Welding Shop. Soldering, brazing and welding.

Students will be assigned practical jobs in relevant shops.

## Recommended Books:

- 1. Workshop Technology, By W. A. J Chapman Butterworth-Heinemann
- 2. Electrical Wiring By Richter and Schwan McGraw-Hill Education

Wiring Manual By Pak Cables Limited

# **ME-113 Engineering Mechanics- I Statics (3,1)**

## **Specific Objectives:**

- To gain basic understanding of various engineering structures in equilibrium.
- To develop knowledge regarding physical phenomena in mathematical terms

## **Course Outline:**

**Force System**. Force, rectangular components, moment, couples, resultant of forces, moments and couples (two and three dimensional systems).

Equilibrium. Mechanical systems, isolation and equilibrium equations for two and

three dimensional systems. Free body diagram, two force and three force members.

**Structures**. Plane trusses, method of joints, method of sections, frames and machine analysis. Forces in beams and cables

**Friction**. Types of friction, dry friction, application of friction.

## Lab Outline:

The experiments of Engineering Mechanics-I will be conducted with Engineering Mechanics-II.

## Recommended Books:

1. Vector Mechanics for Engineers by Beer and Johnston 2. Engineering Mechanics (Statics) by J. L. Meriam

4. Engineering Mechanics (Statics) by R. C. Hibbler

## **Objectives:**

To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan and

To study the process of governance, national development, issues arising in the

modern age and posing challenges to Pakistan.

## **Course Outline:**

## 1. Historical Perspective

a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.

- b. Factors leading to Muslim separatism
- c. People and Land
- i. Indus
- ii. Civilization
- iii. Muslim advent
- iv. Location and Geo-Physical features.
- v.

# 2. Government and Politics in Pakistan

Political and constitutional phases:

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward

## 3. Contemporary Pakistan

a. Economic institutions and issues b. Society and social structure

- c. Ethnicity
- d. Foreign policy of Pakistan and

challenges e. Futuristic outlook of Pakistan

- 1. Burki, Shahid Javed. *State & Society in Pakistan, the Macmillan* Press Ltd 1980.
- 2. Akbar, S. Zaidi. *Issue in Pakistan's Economy.* Karachi: Oxford University Press, 2000.
- 3. S. M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
- 4. Mehmood, Safdar. Pakistan Political Roots & Development. Lahore, 1994.
- 5. Wilcox, Wayne. *The Emergence of Bangladesh.,* Washington: American Enterprise, Institute of Public Policy Research, 1972.
- 6. Mehmood, Safdar. Pakistan Kayyun Toota, Lahore: Idara-e-Saqafat-e-Islamia,

Club Road, nd.

- 7. Amin, Tahir. *Ethno National Movement in Pakistan,* Islamabad: Institute of Policy Studies, Islamabad.
- 8. Ziring, Lawrence. *Enigma of Political Development.* Kent England: WmDawson & Sons Ltd, 1980.
- Zahid, Ansar. *History & Culture of Sindh.* Karachi: Royal Book Company, 1980.
  10.
  Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III.
  Islamabad: National Institute of Historical and cultural Research, 1998.
- 11. Sayeed, Khalid Bin. *The Political System of Pakistan.* Boston: Houghton Mifflin, 1967.
- 12. Aziz, K. K. Party, Politics in Pakistan, Islamabad: National Commission on

Historical and Cultural Research, 1976.

13. Muhammad Waseem, Pakistan under Martial Law, Lahore: Vanguard,

1987. 14. Haq, Noor ul. *Making of Pakistan: The Military Perspective.* Islamabad:

National Commission on Historical and Cultural Research, 1993.

# ME-221THERMODYNAMICS-II (3,1)

## **Specific Objectives:**

• To introduce turbo-machinery (Turbines, compressors and engines etc.)

To study the behavior of ideal and real gas mixtures.

 Understanding of different thermodynamic systems and to deal with real- world engineering problems in order to improve the performance of such systems

**Course Outline:** 

**Mixture with chemical reaction**: Combustion reaction equations, stoichiometric chemical reaction, air-fuel ratio, rich and lean mixtures, enthalpy of formation.

**Compressors:** classification and working principles, single stage and multistage Compressor compressors, inter-cooling, efficiencies and P-V diagrams of velocity diagrams of centrifugal compressors, reciprocating performance characteristics and working regimes.

**Boilers:** generation of steam through boilers, classification and configurations of boilers and their applications, boiler efficiencies and heat balance sheet.

**Nozzles:** Introduction to nozzles, flow through steam nozzle and its efficiencies, their classification working principles.

**Turbines:** Steam turbine, their classification and working principles.

**Introduction to internal combustion engines:** Two and four-stroke engines, SI and CI engines, carburetion and fuel injection system.

## Lab Outline:

Experiments related to the course outline of Thermodynamics-I & II will be covered in the Lab class.

- 1. Fundamentals of Engineering Thermodynamics, *By M. J. Moran and H. O. Shapiro,* John Wiley & Sons
- Fundamentals of Thermodynamics, By Sonntang, Borgnakke, Van Wylen John Wiley &
  - Sons
- 3. Thermodynamics, An Engineering Approach, By Yunus Cengel, Michael A. Boles McGraw-Hill
- 4. Applied Thermodynamics for Engineering Technologists, By T. D. Eastop and A. McConkey
- 5. Basic Engineering Thermodynamic, By Rayner Joel Prentice Ha

# **ME-211 Engineering Mechanics- II Dynamics (3,1)**

## **Specific Objectives:**

To gain fundamental concepts of bodies under dynamic conditions

• To implement laws of motions to components / structures under the influence of forces

## Course Outline:

**Kinematics of Particles**. Rectilinear motion, plane curvilinear motion, rectangular coordinates, normal and tangential coordinates polar coordinates.

**Kinetics of Particles**. Force, mass, and acceleration, Newton's second law of motion, equations of motion, kinetic diagrams, rectilinear motion, curvilinear motion. Work and energy, potential 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.

## Lab Outline:

Experiments related to the course outline of Engineering Mechanics-I & II will be covered in the Lab class.

- 1. Vector Mechanics for Engineers (Dynamics) by Beer and Johnston
- Engineering Mechanics (Dynamics) by J. L. Meriam 3. Engineering Mechanics (Dynamics) by R. C. Hibbler

# ME-212 MECHANICS OF MATERIALS-I (3,1)

## **Specific Objectives:**

- To gain basic understanding of the concepts of solid mechanics and familiarize students with the methods of analysis.
- To study the response of different engineering materials under various types of loadings.

## Course Outline:

Mechanical properties of materials, tensile, compressive and shear stress & strain, Hooke's law, stress strain relationship, thermal stresses, torsion of circular bars, shearing force and bending moment, pure bending of beams, shear stresses in

beams, beam deflection using various methods, residual stresses, analysis of statically indeterminate problems, stress concentration, thin and thick curved bars, thin walled pressure vessels.

## Lab Outline:

The experiments of Mechanics of Materials-I will be conducted with Mechanics of Materials-II.

- Mechanics of Materials by Ferdinand P. Beer & Russel Johnston Jr. McGraw-Hill
- 2. Mechanics of Materials by R. C. Hibbler
- Mechanics of Engineering Materials by P. P. Benham & R. J. Crawford Longman Sc & Tech
- 4. Mechanics of Materials by Popov

# ME-222 FLUID MECHANICS-I (3,1)

## **Specific Objectives:**

- To introduce the basic principles of fluid mechanics.
- Understanding the basic concepts in fluid static and fluid dynamics

## Course Outline:

**Fluid Properties:** Ideal and real fluids, viscosity and compressibility of fluids, fluid pressure, absolute, gauge and vacuum pressures, difference between static and dynamic pressure, flow velocity and flow rate

**Fluid statics:** Measurement of static pressure, stagnation pressure, pressure in a fluid under the action of gravity, homogeneous fluid, constant-velocity rotation of a liquid around-fixed axis, hydraulic circuits, 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.

**Fluid dynamics:** One dimensional inviscid 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, flow in conduits

**Dimensional analysis, similitude and its applications:** Buckingham- Pi theorem, Reynolds' law of similitude

## Lab Outline:

The experiments of Fluid Mechanics-I will be conducted with Fluid Mechanics -II.

- 1. Fundamentals of Fluid Mechanics, *By Munson, Young and Okiishi,* John Wiley & Sons
- 2. Fluid Mechanics, By Frank M. White McGraw-Hill
- 3. Fluid Mechanics by Shames McGraw-Hill. McGraw-Hill

# EN-201 COMMUNICATION SKILLS AND REPORT WRITING (2,0) Course Outline:

## Knowledge Area / Sub Area: Humanities / English - II

#### Specific Objective:

To enable the students to meet their real life communication needs

## **Course Outline:**

Paragraph writing: Practice in writing a good, unified and coherent paragraph

Essay writing: Introduction

#### CV and job application

Translation skills: Urdu to English

**Study skills**: Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

Academic skills: Letter / memo writing and minutes of the meeting, use of library and internet recourses

**Presentation skills:** Personality development (emphasis on content, style and pronunciation)

## Note: documentaries to be shown for discussion and review

## **Recommended Books:**

- a) Grammar
  - A. J. Thomson and A. V. Martinet, *Practical English Grammar*.
     Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- b) Writing
  - 1. Marie-Chrisitine Boutin, Suzanne Brinand and Francoise Grellet, *Writing. Intermediate.* Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
  - Rob Nolasco, Writing. Upper-Intermediate. Oxford Supplementary
     Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
- c) Reading
- 1. Brian Tomlinson and Rod Ellis, *Reading. Advanced*. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.

# ME-213 ENGINEERING MATERIALS (3,0)

## Specific Objectives:

- To understand the appropriate use and selection of various engineering materials in designing and manufacturing of components and associated processes.
- To acquire knowledge related to the microstructure of engineering materials

## Course Outline:

#### Metals

**Structure of Metals:** Crystalline structure of metals, allotropy. Crystallographic planes, mechanisms in metals, slip and slip systems, dislocation, twinning, yield phenomenon and strain aging, Bauchinger effect.

**Metals and Alloy Systems:** Production of iron, wrought iron, cast iron. Production of steel and its classification, ferrite, austenite, S-iron, cementite, pearlite, martensite, bainite, etc. Iron-carbon phase diagram, alloying elements and their effect on the properties of alloy steel. Refining of copper, aluminum and zinc. Aluminum alloys, zinc alloys, copper alloys, brass and bronzes. Metals and alloys for special application. Corrosion of metals anti-corrosive coatings and paints.

**Material Forms and Designation:** Heat treatment critical temp, transformation on heating/cooling, annealing, normalizing, tempering, quenching, austempering, hardening, rolling processes and production of various steel sections such a billet, bar, rod, channel, Roll load calculation, British standards and ASTM standard specification on iron/steel.

## Non Metals

Composition, properties and uses of plastics, rubber, ceramics, fiberglass, composite materials and polymers.

**Polymers:** Molecular structure, bonding & classification of polymer compounding,

forming operations etc., plastics.

**Ceramics and refractories:** Ceramic bonding, properties, ceramics material, crystalline and amorphous, silica, glass etc., refractory materials and their types, Introduction to Composite Materials, Material failure analysis.

1. Materials and Processes in Manufacturing, *By E. P Degarmo* Prentice Hall 2.

Process and Materials of Manufacturing By Lindberg.

3. Ceramic Science for Materials Technologist By T. J McCalm 4.

Engineering with polymers By P. C. Powell Springer

- 6. Introduction to Engineering Materials By William F. Smith McGraw-Hill Science
- 7. Material Science By David Collister

# **EE-201 ELECTRONICS ENGINEERING (2,1)**

## Course Outline:

#### Conduction in Solids

Introduction, Mechanics of conduction, Mobility, Bohr's model for the elements, Energy level diagrams for solids, Conductors, Intrinsic and extrinsic semiconductors, Electron-hole pairs in an intrinsic semiconductor, Distribution of electron and hole in conduction and valence bands, Recombination and lifetime.

#### Semiconductors and Diodes

Donor and acceptor impurities, Zero biased, Forward biased and reverse biased junction diodes, Junction diode current equation, Depletion barrier width and junction capacitance, Diffusion capacitance, Zero and Avalanche break down, Hall effect, Fabrication of pn junction, Diodes.

#### **Electron Emission Devices**

Types of electron emissions, Thermionic diode, Volt ampere characteristics, Child Langmuin power Law, Gas filled diode, Thermionic triode, Parameters and characteristics, Tetrode, Pentode, and beam power tubes, Parameters and characteristics.

#### Simple Diode Circuits and Applications

Mathematical and graphical analysis of diode circuits, the ideal and non-ideal diodes, Piecewise linear models, Analysis of piecewise linear models of vacuum tube and junction diodes, The half wave rectifier, The inductance filter, The inductance capacitance filter circuits, Zener and gas diode, Voltage regulator circuits, Clamping and DC restorer circuits, Voltage doubler circuits, Clipping and limiting circuits.

#### **Bipolar and Field Effect Transistors**

Transistor biasing and thermal stabilization, The operating point, Bias stability, Collector to base bias, Fixed bias, Emitter feedback bias, Stabilization for the self-biased circuits, Field effect transistors, Basic principles and theory, Types, FET characteristics, Different configurations-common gate, Common source and common drain, The FET, small signal model, Parameters, Biasing of the FET.

#### Amplifier Circuits

Introduction "h" parameters, Hybrid model for transistor, Elementary treatment, Low frequency transistor amplifier circuits, Stage cascaded LF.

# ME-215 MECHANICS OF MATERIALS-II (3,1)

## **Specific Objectives:**

- To gain advanced understanding of the mechanical behavior of materials such as plastic deformation.
- Study of 3-D stress analysis

## **Course Outline:**

Analysis of stress and strain in two and three dimensions, principal stresses and strains, Mohr's circle for stress and strain, thick walled cylinders, symmetrical and asymmetrical loading, introduction to fracture mechanics, impact loading, fatigue and creep, virtual work, theories of failure. Theory of columns.

## Lab Outline:

Experiments related to the course outline of Mechanics of Materials-I & II will be covered in the Lab class.

## Recommended Books:

- Mechanics of Materials by Ferdinand P. Beer & Russel Johnston Jr. McGraw-Hill
- 2. Mechanics of Materials by R. C. Hibbler
- Mechanics of Engineering Materials by P. P. Benham & R. J. Crawford Longman Sc & Tech
- 4. Mechanics of Materials by Popov

# ME-223 FLUID MECHANICS-II (3,1)

## **Specific Objectives:**

- To understand the working of Turbo-machinery (Pumps, Turbines, etc.)
- To understand and use boundary layer and differential equations to determine parameters in internal and external flows.
- Understand the concept of Non-Newtonian flows.
  To study compressible flow

## **Course Outline:**

#### Two and three dimensional ideal fluid flow

Potential flow, circulation, stream function and velocity potential, uniform flow, two dimensional source and sink, vortex, the doublet, lift and drag forces.

#### Two and three dimensional viscous fluid flow

Navier stokes equations of motion, two dimensional flow between parallel plates, and flow in a circular pipe, creep flow, Reynold's equation, and hydrodynamic lubrication in journal bearing.

#### Boundary layer theory

Boundary layer theory, laminar & turbulent boundary layers, boundary layer control, airfoil cascades.

#### Fluid machinery

Similarity relations for turbo machines, specific speed, classification of turbo machines, impulse turbines, reaction turbines, hydraulic jacks, pumps and their performance curves.

#### Computational fluid dynamics

Introduction, numerical operations for differentiation and integration, programming procedure, simple exercise problems.

## Lab Outline:

Experiments related to the course outline of Fluid Mechanics-I & II will be covered in the Lab class.

- 1. Fundamentals of Fluid Mechanics, *By Munson, Young and Okiishi* John Wiley & Sons
- Fluid Mechanics, By Frank M. White, McGraw-Hill 3.
   Fluid Mechanics, By Shames, McGraw-Hill.
- 4. Engineering Fluid Mechanics, By Clayton T. Crowe, Donald F. Elger, John A. Roberson, John Wiley & Sons

# **GS-201 Statistics & Probability for Engineers (2,0)**

#### **Course Outline:**

**Statistics:** Introduction, Types of data & variables, presentation of data, object, classifications, Tabulation, Frequency Distribution, Graphical Representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

#### Measures of Central Tendency and Dispersion:

Statistics Averages, Median, Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems. **Curve Fitting:** Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves, related problems, Principle of least squares, Second order Statistics & Time series.

#### Simple Regression & Correlation:

Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), related problems. **Sampling and Sampling Distributions:** 

Introduction, Population, Parameter & Statistics, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-

Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

#### Statistical Inference and Testing of Hypothesis:

Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests. Application in related problems.

#### Probability:

Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Baye's rule. Related problems in practical significance.

#### **Random Variables:**

Introduction, Discrete & Continuous random variables,Random Sequences and transformations, Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markove random walks chain/Related problems.

#### **Probability Distributions:**

Introduction, Discrete probability distributions, Binomial, Poisson, Hypergeometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

# GR-202 Islamic Studies/Ethics (2,0)

## Specific Objectives:

This course is aimed at:

1. To provide Basic information about Islamic Studies

2. To enhance understanding of the students regarding Islamic

Civilization 3. To improve Students skill to perform prayers and other worships

4. To enhance the skill of the students for understanding of issues related to faith and religious life.

# **Course Outline: INTRODUCTION TO QURANIC STUDIES**

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

# STUDY OF SELECTED TEXT OF HOLLY 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)

5) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No. 6, 21, 40, 56, 57,

58.)

- 6) Verses of Surah Al-Hashar (Verse No. 18,19, 20) Related to thinking, Day of Judgment
- 7) 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

## SELECTED STUDY FROM TEXT OF HADITH

## INTRODUCTION TO ISLAMIC LAW AND 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) Quran & 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 2) Elements of Family

3) Ethical Values of Islam

## **Recommended Books:**

1) Hameed ullah Muhammad, "**Emergence of Islam**", IRI, Islamabad 2) Hameed ullah Muhammad, "**Muslim Conduct of State**"

- 3) Hameed ullah Muhammad, 'Introduction to Islam
- 4) Mulana Muhammad Yousaf Islahi,"
- 5) Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
- 6) Ahmad Hasan, "**Principles of Islamic Jurisprudence**" Islamic Research Institute, International Islamic University, Islamabad (1993)
- 7) Mir Waliullah, "Muslim Jurisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
- 8) H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
- 9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

# ME-311 MACHINE DESIGN AND CAD-I (2,1)

## Specific Objectives:

- To design common machine elements and to gain experience in solving design problems.
- To prepare professional quality solutions and effectively communicate the results of analysis and design.

## **Course Outline:**

Basic criteria of design of machine parts, determination of permissible and actual stresses, factor of safety, design of keys, cotters, and couplings, Design of brakes and clutches, flywheel, Design of welded, riveted and bolted joints, Design of

translation screws, Design codes and standards, tolerances, standards of fits & tolerances. Fundamentals of CAD.

## Lab Outline:

Two & Three Dimensional modeling of machine components using CAD software.

## **Recommended Books:**

- 1. Mechanical Engineering Design, By J. E. Shigley, McGraw-Hill
- 2. Machine Design, An Integrated Approach, By R L Norton, McGraw-Hill.
- 3. Design of Machine Elements, By M. F. Spotts, Prentice Hall
- 4. Fundamentals of Machine Component Design, By R. C. Juvinall & K. M. Marshek, John Wiley
- 5. Related CAD software user's guide

# ME-312 MECHANICS OF MACHINES (3,1)

## **Specific Objectives:**

- To understand the mechanics and mechanisms involved in various machine elements
- To learn the application of various machine components.

## Course Outline:

Simple mechanism, screw threads and efficiency, friction of pivot, collar and conical bearing, cone, plate and centrifugal clutch, belts and rope drives, chains and sprockets, controlling bands and shoe brakes, governors, effort and power. sensitivity, force and stability, gyroscope, geometry of gears, gear trains. Linkages: synthesis dvnamometers. and analysis, position, velocitv and acceleration analysis, turning moment diagram, flywheels, cam and follower. steering gears, balancing.

## Lab Outline:

Experiments related to the course outline mentioned above will be covered in the Lab class.

- 1. Theory of Machines and Mechanisms, By J. E. Shigley & Uicker, McGraw-Hill
- 2. Mechanism Design, By Erdman and Sanders, McGraw-Hill.
- 3. Principles of Mechanisms, By F. Dyson, Oxford University Press.
- 4. Theory of Machines, *By W.G. Green* Blackie & Son.

# ME-313 MANUFACTURING PROCESSES (3,1)

## **Specific Objectives:**

- To understand various manufacturing processes.
- To get hands on experience on various types of machine tools.
- To apply effectively various manufacturing techniques/operations used in broad spectrum of engineering and manufacturing companies.

## **Course Outline:**

Forming & shaping processes and equipment, material removal, cutting tools, machining processes for producing various shapes, extrusion and drawing, sheet metal forming, forming & shaping plastics & composite materials, joining process & equipment, solid state welding process, metal casting process & equipment: powder metallurgy, surface treatment, non-conventional machining process, jigs & fixtures

## Lab Outline:

Experiments related to the course outline mentioned above will be covered in the Lab class.

## **Recommended Books:**

- 1. Fundamentals of Modern Manufacturing, By M. P. Groover John Wiley & Sons
- 2. Manufacturing Engineering and Technology By Kalpakjian Prentice Hall
- 3. Materials and Processes in Manufacturing By E. P Degarmo Prentice Hall
- 4. Process and Materials of manufacture By F. A Lindberg.
- 5. Introduction to Manufacturing Process By John Aschey. 6.

Manufacturing Process By B. H Amstead, P. F Ostwald.

# **ME-314 INTRODUCTION TO MECHATRONICS (2,1)**

## **Specific Objectives:**

- To acquire fundamental knowledge for electro mechanical design.
- To develop synergistic integration of mechanical, electrical, electronic engineering applications

## **Course Outline:**

#### Introduction

Sensors and transducers, transducer characteristics, sensors for measuring displacement, strain, force, pressure, temperature and motion, encoders.

#### Computer architecture

Microprocessor, micro-programming, Bus systems, assembly language programming

#### Motors with drivers

Stepper and servo motors, introduction to programmable logic controller (PLC).

#### Interfacing

Ports, input/output, analog to digital converter, sampling theory, digital to analog converter, sample and hold, multiplexer, interfacing switches, LEDs, stepper motors and DC motors to micro-controllers.Introduction to condition monitoring, and sensor fusion.

## Recommended

#### Books:

1. Design with Microprocessors for Mechanical Engineers, By A. K. Stiffler, McGraw-Hill

2 Microprocessor Architecture, Programming and Applications, By Goankr,

Prentice Hall

- 2. Introduction to Mechatronics & Measurement Systems By David G. Akiatore, Michael B. Histard
- 3. Mechatronics An integrated approach By Clarence W. Desilva

# **GS-301** Applied Mathematics – III Vector Calculus and PDEs (3,0)

## **Course Outline:**

Basic Concepts, Matrix Addition, Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination Solutions of Linear Systems, Existence, Uniqueness

General Form Determinants, Cramer's Rule, Inverse of a Matrix, Gauss-Jordan Elimination, Application of Inverse of a Matrix to Cryptography Linear Systems: LU-Factorization, Vector Spaces, Subspaces, Linear Independence, Linear Transformations, Matrix representation of linear transformations, Relations between matrix representations, Applications of linear and non linear transformations to images in plane, Rank of a Matrix, Kernel and range, Diagonal matrix representation of a linear operator, Eigen values, Eigenvectors, Applications of Eigen values, Eigenvectors in Difference Equations/ Quadratic Forms/ Normal Modes of an Oscillating System

Similarity of Matrices, Basis of Eigenvectors. Diagonalization, Symmetric, Skew Symmetric, and Orthogonal Matrices, Complex Matrices: Hermitian, Skew-Hermitian, Unitary, Inner product spaces, norm of a vector, angle, orthogonal vector, distance, inner product on complex space.

## **Recommended Books**

- 1. Advanced Engineering Mathematics **5th Edition** By C.R. Wylie McGraw-Hill Education
- 2. Advanced Engineering Mathematics, 8th Edition By HTErwin Kreyszig John Wiley & Sons

# ME-315 MACHINE DESIGN AND CAD-II (3,0)

## Specific Objectives:

- To design common machine elements and to gain experience in solving design problems.
- To prepare professional quality solutions and to effectively communicate the results of analysis and design.

## Course Outline:

Kinematics, force analysis and design of spur, helical, bevel & worm gears, design of rolling contact bearings, hydrodynamic theory of lubrication, journal bearings, mechanical springs, design of belts, ropes and chains, design of shafts. Introduction to experimental stress analysis. Introduction to Finite Element Analysis.

## Lab Outline:

Assembly modelling and generation of engineering drawings using related CAD software. Use of Finite Element Analysis software to solve related engineering problems.

- 1. Mechanical Engineering Design, By J. E. Shigley, McGraw-Hill
- 2. Machine Design, An Integrated Approach, By R L Norton, McGraw-Hill.
- 3. Design of Machine Elements, By M. F. Spotts, Prentice Hall
- 4. Fundamentals of Machine Component Design, By R. C. Juvinall & K. M. Marshek, John Wiley
- 5. Related CAD and FEA software user's guide

# **ME-316 CONTROL ENGINEERING & INSTRUMENTATION (2,1)**

#### **Specific Objectives:**

To gain basic understanding and implementation of various control systems
 To learn mathematical modeling of various systems

## **Course Outline:**

#### **Basic concepts**

System, control system, input, output, open-loop and closed loop control systems, elements of a general control system, examples of control system.

#### Mathematical modeling of physical system

Operational notation, grounded chair representation, series parallel, laws, equations of motion for spring mass damper systems, levered system, rotational system, geared system, electrical components and R. L. C circuits, electrical analogies for mechanical systems, scale factors, thermal systems and fluid system.

#### Transfer functions and systems response

Review of Laplace transform, impulse, step and ramp functions, concept of transfer functions of common components, block diagram algebra, signal flow graphs, impulse, step, and ramp response of first and second order systems, characterization of response (time constant, gain, overshoot, rise time, settling time, steady state error, etc.) relation of system response to location of system poles and zeros.

#### Stability of control system

Concept of stability, Routh Hurwitz criterion, root locus methods and its use in control System design, digital control.

#### Lab Outline:

Experiments related to the course outline mentioned above will be covered in the Lab class.

#### **Recommended Books:**

1. Automatic Control Systems, By B. C. Kuo, F. Golnaraghi, John Wiley & Sons.

2. Modern Control System, By Richard C. Dorf, Prentice Hall.

- 3. Automatic Control, By J. J. Distofano et al.
- 4. Automatic Control, By Francis H. Raven.

# GS-302 Applied Math-IV (Fourier and Complex Analysis) (3,0)

Introduction to complex number systems, Argand's diagram, modulus and argument of a complex number, polar form of a complex number, De Moivre's theorem and its applications, complex functions, analytical functions, harmonic and conjugate, harmonic functions, Cauchy- Riemann equations, line integrals, Green's theorem, Cauchy's theorem, Cauchy's integral formula, singularities, poles, residues, contour integration and applications; Laplace transform definition, Laplace transforms of elementary functions, properties of Laplace transform, periodic functions and their Laplace transforms, inverse Laplace transform and its properties, convolution theorem, inverse Laplace transform by integral and partial fraction methods, Heaviside expansion formula, solutions of ordinary differential equations by Laplace transform, applications of Laplace transforms; series solution of differential equations, validity of series solution, ordinary point, singular point, Forbenius method, indicial equation, Bessel's differential equation, its solution of first kind and recurrence formulae, Legendre differential equation and its solution, Rodrigues formula; Fourier transform definition, Fourier transforms of simple functions, magnitude and phase spectra, Fourier transform theorems, inverse Fourier transform, solutions of differential equations using Fourier transform.

## **Recommended Text:**

1. Erwin Kreyszig, "WIE Advanced Engineering Mathematics," Ninth Edition, 2005, International

# ME-321 HEAT AND MASS TRANSFER (3,1)

## **Specific Objectives:**

- Understanding of basic principles of heat & mass transfer involved in thermo- fluids as well as another related fields.
- To design main mechanical component of industries e.g. heat exchanger, boilers, condensers, evaporators.

## Course Outline:

#### Conduction

Heat equation, Fourier's law, one dimensional steady state heat conduction through plane and composite walls, cylinders and spheres with and without heat generating sources, critical thickness of insulation, heat transfer through extended surfaces, transient conduction, lumped capacitance method.

#### Convection

Newton's law of cooling, boundary layer, natural (free) and forced convection heat transfer. coefficient of heat transfer for free and forced convection, effects of laminar, transition and turbulent flow on coefficient of heat transfer, flow over flat plates, heat transfer for flow through pipes and ducts, non-dimensional parameters related to heat transfer and their applications. Shear stresses, friction coefficient for fully developed flow, Reynolds analogy, heat transfer with phase change, boiling, condensation.

#### Radiation

Stefan Boltzmann's law, black body radiation, absorptivity, reflectivity, transmissivity.

Wien's Displacement law, Kirchoff's law, gray body radiation. Radiation shape factor and its applications.

#### Mass transfer

Ficks law and its application, analogy between momentum, heat and mass transfer.

#### Heat exchangers

Classification, overall heat transfer coefficient. LMTD and NTU methods.

#### Lab Outline:

Experiments related to the course outline mentioned above will be covered in the Lab class.

#### **Recommended Books:**

1. Fundamentals of Heat Transfer By Incropera & DeWitt, John Wiley & Sons 2.

Heat Transfer, A Practical Approach By Y. A. Cengel, McGraw-Hill

- 3. Heat Transfer By J. P. Holman, McGraw-Hill
- 4. Elements of Heat Transfer by *Frank Keith*, International Text Books Co.

# **MS-301 Engineering Management and Economics (2,0)**

## **Course Outline:**

#### Introduction

Engineering economy defined; Measures of financial effectiveness; nonmonetary factors and multiple Objectives; principles of engineering economy.

#### The Economic Environment

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

#### Cost Concepts & Analysis

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

#### Time Value of Money

Simple interest; Compound Interest; Cash flow diagrams; Interest formulas; Nominal versus effective interest rates; Continuous compounding.

#### **Depreciation and Depletion**

Purpose of depreciation; Types of depreciation; Economic life. What can be depreciated?

#### **Comparing Alternatives**

Present economy; Selection among machines, materials, processes, and designs, Payback period method; Present worth method; Uniform annual cost method; Rate of return method; Alternatives having identical lives. Alternatives having different lives. **Production Concepts & Mathematical Models** 

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

#### Linear programming

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

#### **Capital Financing and Budgeting**

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

#### **Industrial Relations**

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

# GR-301 Ethical & Legal dimensions for Engineers

#### Specific Objectives:

This course introduces contemporary and controversial ethical issues facing the business community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.

At the completion of the course requirements, the student will be able to:

- a. Define ethics
- b. Describe the evolution of ethics
- c. Describe major ethical perspectives
- d. Understand and apply n ethical decision-making framework
- e. Understand social responsibility from several dimensions
- f. Understand how the organization influences ethical decision-making
- g. Examine how significant others influence ethical decision-making
- h. Develop an effective ethics programmed.
- i. Understand international ethics.

## **Course Outline:**

**An Overview of Engineering Ethics:** Ethics Defined, Social Responsibility, and Ethics, The Development of Ethics, Why study Ethics?, Framework for Studying Ethics.

**Ethical issues in Engineering:** Foundation of Ethical Conflict, Classifications of Ethical, Issues, Ethical Issues Related to Participants and Functional Areas of Engineering, Recognizing an Ethical Issue.

**Applying Moral Philosophies to Engineering Ethics:** Moral Philosophy Defined, Moral Philosophy Perspectives

**Social Responsibility:** The Economic Dimension, The legal Dimension, The Ethical Dimension, the Philanthropic Dimension

**An Ethical Decision-Making Framework:** Ethical Issue Intensity, Individual Factors: Stages of Cognitive Moral Development, Corporate Culture, Significant others, Opportunity, Engineering Ethics Evaluations and Intentions, Using the Ethical Decision-Making Framework to Improve Ethical Decisions

**How the Organization Influences Ethical Decision Making:** Organizational Structure and Engineering Ethics, the role of Corporate Culture in Ethical Decision-Making, Group Dimensions of Organizational Structure and Culture, Implications of Organizational Relationships for Ethical Decisions.

The Role of Opportunity and Conflict: Opportunity, Conflict.

**Development of an Effective Ethics Programmed:** An Effective Ethical Compliance, Programmed, Codes of Ethics and Compliance Standards. High-Level Manager's Responsibility for Ethical Compliance Programmed and the Delegation of Authority, Effective Communication of Ethical Standards. The Influence of Personal Values in Engineering Ethics Programmers, the Ethical Compliance Audit.

# **ME-421 I.C ENGINE (3,0)**

## COURSE OUTLINE:

Introduction. Vehicle structural layout. Automobile systems (Suspension, Steering, Brakes, Transmission, etc.) Engine systems: Cooling, Lubrication, EFI and carburetors. Engine classification, Combustion reaction of engine fuels, Real engine cycle. Working principles of SI and CI engines, Ignition delay and combustion phases. Testing and performance characteristics of petrol and diesel engines. Knocking characteristics, Octane and Cetane numbers, Engine valve timing, Pressure-crank angle diagram. Working principle of turbo-charged engine & performance characteristics. Engine emissions and their control. Exhaust gas recirculation (EGR) system. Thermal reactor and catalytic converters. Trade off of NOx and HC emissions. Fuel injected petrol engine and its performance, Advantages over conventional petrol engine. Engine performance & fuel savings. Introduction to duel fuel / multi fuel engines, CNG engines. Engine lubrication and lubricants, fuel additives

#### **Recommended Books:**

1. Internal Combustion Engine BY R.K Rajpoot

2. Internal Combustion Engine Fundamentals (McGraw-Hill) by John Heywood

# **GS-401** Numerical Analysis & Computation (3,1)

## **Course Outline:**

Introduction, basic ideas, concepts and terminology, , essential elements of numerical analysis, continuum formulation, solution domain, discretization, solution algorithm, polynomials and finite differences, round-off and solution errors, introduction to Least-square, Min-max, cubic splines, and piece-wise osculating polynomials, collocation polynomials and finite differences, round-off and solution to Least-square, Min-max, cubic splines, and piece-wise osculating polynomials, collocation polynomials with advantages and disadvantages, Newton forms of linear interpolation and quadratic interpolation polynomials, Progression of forward, backward and central differences in tabular form, and construction of polynomials, operator algebra, solution of equation with one, two and three variables, III-conditioning of equations set, direct methods of solution, Gaus elimination method, LU decomposition method, matrix inversion, iterative methods of solution, Eign-value problems, characteristics polynomial and the stability criterion, solution of first order ordinary differential equations, initial value and boundary value problems, Euler predictor method and Euler predictor cum corrector method of solving and ordinary differential equation, one-step solution methods second order Runge-Kutta method.

## **Recommended Books**

- 1. Numerical Analysis by Richard L Burden and J Douglas Fairs
- 2. Numerical Analysis by Francis Scheid, Schaum's outline series, McGraw Hill
- 3. Applied Numerical Analysis by Curtis F Gerald, Addison-Wesley
- 4. Introduction to Numerical Analysis by F B Hillbrand, Tata McGraw Hill

# **ME-422 REFRIGERATION AND AIR CONDITIONING (3,1)**

## **Specific Objectives:**

- To understand refrigeration systems.
- To develop basic ideas about cycle analysis and designing parameters pertaining to refrigeration and air conditioning systems
- To deal with the problems related to architectural, building services, HVAC, equipment

## **Course Outline:**

#### **Refrigeration cycles**

Reversed Carnot and Joule Cycles, vapour compression and vapour absorption systems, COP, pressure- enthalpy chart, types of refrigerants, air cycle refrigeration, multiple effect compression, multi-stage compression, heat pump

#### Air conditioning

Indoor and outdoor air conditions, comfort conditions and comfort zone, indoor air quality, psychrometry.

#### Central air-conditioning system

Essential components of central air-conditioning plant, water chiller and water heater, air handling unit, chilled water and hot water recirculation system, return air supply system, fresh air supply system air mixture chamber, supply fan, air dust cleaning and bacteria removal, air supply and air return terminals, diffusers and grilles, CFM rating and tons of air-conditioning of a central air-conditioning plant.

#### Load calculation and system design

Cooling and heating load calculation procedures, duct sizing and piping design, pumps and fans selection, air ventilation: calculation of fresh air supply of a multistory building, air handling unit for untreated fresh air, forced convection based air ventilator design.

## Lab Outline:

Experiments related to the course outline mentioned above will be covered in the Lab class.

#### **Recommended Books:**

- 1. Heating, Ventilating, and Air-Conditioning Analysis and Design, *By McQuiston, Parker and Spitler* John Wiley & Sons
- 2. Heating and Cooling of Buildings, *By Ed. Kreider, Curtiss & Rabl* McGraw-Hill 3. Principles of Refrigeration, By Dossat, R. J., John Wiley
- 4. HVAC Systems Design Handbook, By Haines, Roger W. Wilson, Lewis McGraw-Hill Companies
- 5. ASHRAE Handbook

## ME-411 MECHANICAL VIBRATIONS (3,1)

## **Specific Objectives:**

- To determine the effect of vibration on the performance and safety of systems.
- To control the effects of vibration.

## **Course Outline:**

**Oscillatory motion:** Elements of vibrating system, harmonic motion.

**Single degree of freedom systems:** equation of motion: Newton's method, energy method, finding natural frequencies, Rayliegh method and Holzer method, undamped free vibration, viscously damped free vibration, logarithmic decrement, harmonically excited vibration, vibration isolation, vibration measuring instruments.

**Two degree of freedom systems:** normal modes of vibration, coordinate coupling, forced harmonic vibration, vibration absorber, vibration damper, orthogonality conditions.

**Vibration of elastic bodies:** free and forced vibration of cables and uniform bars, free and forced lateral vibrations of simply supported thin beams, torsional vibration of circular shafts with single rotor and two rotors, critical speed of rotating shafts.

## Lab Outline:

Experiments related to the course outline mentioned above will be covered in the Lab class.

- 1. Mechanical Vibrations: Theory & Applications, By W. T. Thompson Prentice Hall
- 2. Mechanical Vibrations, By S. S. Rao. McGraw-Hill
- 3. Elements of Vibration Analysis By L. Meirovitch, McGraw-Hill