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:


GS-102 Applied Physics (2,0)

GS-103 Applied Chemistry (2,0)


Physical Chemistry

Chemical Thermochemistry, Hess’s Law, heat of formation and reaction, relation between H and U, measurement of heat reaction, Bomb calorimeter


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

b) Reading/Comprehension

c) Speaking

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

**Specific Objectives:**
- To learn fundamentals of computer hardware and basic terminologies.
- 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 cone, 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:


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

Course Outline:

Recommended Books:


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, Hysteretic loss , Eddy current loss, Lifting power of range

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 Sonntag, 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.
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.


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
3. Engineering Mechanics (Statics) by R. C. Hibbeler
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**
   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

Recommended Books:

**ME-221 THERMODYNAMICS-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.

Recommended Books:

1. Fundamentals of Engineering Thermodynamics, By M. J. Moran and H. O. Shapiro, John Wiley & Sons
2. Fundamentals of Thermodynamics, By Sonntag, 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.


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.

Recommended Books:

1. Vector Mechanics for Engineers (Dynamics) by Beer and Johnston

   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.

Recommended Books:

   McGraw-Hill
   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.

Recommended Books:

1. Fundamentals of Fluid Mechanics, By Munson, Young and Okiishi, John Wiley & Sons
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

b) Writing

c) Reading

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.


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.

Recommended Books:
1. Materials and Processes in Manufacturing, *By E. P Degarmo* Prentice Hall
2. Process and Materials of Manufacturing *By Lindberg*.
   Engineering with polymers *By P. C. Powell* Springer
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.
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:

   McGraw-Hill
   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.

Recommended Books:

1. Fundamentals of Fluid Mechanics, By Munson, Young and Okiishi John Wiley & Sons
   Fluid Mechanics, By Shames, McGraw-Hill.
GS-201 Statistics & Probability for Engineers (2,0)

Course Outline:

Measures of Central Tendency and Dispersion:

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:

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)
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:
3. Design of Machine Elements, By M. F. Spotts, Prentice Hall
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, dynamometers. Linkages: synthesis and analysis, position, velocity 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.

Recommended Books:
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
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
3. Introduction to Mechatronics & Measurement Systems By David G. Akiatore, Michael B. Histard
4. 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
Recommended Books


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.

Recommended Books:

3. Design of Machine Elements, By M. F. Spotts, Prentice Hall
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:
3. Automatic Control, By J. J. Distefano 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:**


**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

**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:**


**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


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:


Recommended Books:

1. Internal Combustion Engine BY R.K Rajpoot

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

Course Outline:


Recommended Books

1. Numerical Analysis by Richard L Burden and J Douglas Fairs
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 multi-story 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 Spitzer John Wiley & Sons
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.

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.

Recommended Books:

3. Elements of Vibration Analysis By L. Meirovitch, McGraw-Hill