

Energy Course Curriculum with short description

ENH-112 Islamic Studies/Professional Ethics

History of Islam: Compilation of the Holy Quran and Hadith, Tawheed, oneness of Allah, Prophet hood, the day of Judgment, Revealed books, Ibadaat (worship) Philosophy of Ibadaat, Namaz, Zakat, Hajj & Sawm, Importance of preaching of Islam, its needs and effects, Difficulties in the ways of preaching of Islam, sectarianism, its causes and effects in Muslim society, definition of Right, classification of Right, importance of Rights, Khutba Hajjatul Wida (last address of the Holy Prophet, peace be upon him), Seeratun-Nabi (Peace be upon him). Life of Holy Prophet (Peace be upon him), Islam and Civilization, Knowledge, and Islam.

ENS-113 Applied Mathematics-I

Complex numbers, Argand diagram, De Moivre's theorem, hyperbolic and inverse hyperbolic functions. Algebra of vectors and matrices, systems of linear equations. Derivative as slope, as rate of change (graphical representation). Extreme values, tangents and normals, curvature and radius of curvature. Differentiation as approximation. Partial derivatives and their application to extreme values and approximation. Integration by substitution and by parts, integration and definite integration as area under curve (graphical representation). Reduction formulae. Double integration and its applications. Polar and Cartesian coordinates, polar curves, radius of curvature, cycloid, hypocycloid, epicycloids, and involutes of a circle.

ENS-123 Applied Physics

Electric charge, Conductors and insulators, Coulomb's law, Electric field, Field due to a point-charge Electric dipole and line of charge, Flux of an electric field, Permittivity of a medium, Gauss's law, Application of Gauss's Law, Electric potential, calculating the potential from electric field, Potential due to a point-charge and a group of point charges. Potential due to a dipole, Potential due to a continuous charge distribution. Capacitors, calculating capacitance, Capacitors in series and parallel, Factors affecting capacitance, Application of Capacitors. Current and Conductors, Electric current and current density, Resistance and resistivity, Ohm's law, The Steady Magnetic Field, Resistors in series and parallel, Temperature dependence of resistance and other factors affecting resistance, Application of resistors. The magnetic field, Magnetic force on a current carrying conductor, Torque on a current loop.

ENS-133 Introduction to Computer Fundamentals

Introducing Computer Systems: Basic Definitions, Computer and Communication Technology, the applications of ICT -particularly for engineering technology. Basic Operations and Components of a Generic Computer System: Basic operations: Input, Processing, output, storage Basic components: Hardware, Software, Data, Users, types of storage devices. Processing Data: Transforming data into information, how computers represent and process data, Processing Devices, CPU architectures. The Internet: The Internet and the World Wide Web- browsers, HTML, URLs/ How DNS works, Email and other programs. Introduction to Embedded Systems: What is an Embedded System, Applications, Components, Programming Languages, Popular Development Platforms. Networking Basics: Uses of networks, Common types of networks (LAN, WAN, MAN etc.), Introduction to OSI Model, Future of Networks. Database Management: Hierarchy of Data, Maintaining Data, Database Management Systems. Exposure to ICT Tools and Blogs (Student Assignment). Protecting your privacy, your computer and your data: Basic Security Concepts, threats to users, threats to hardware, threats to Data.

ENS-143 Applied Chemistry

Chemical kinetics and catalysis: Introduction to rate equation and reaction order, reaction mechanism, relation between rate equation and reaction mechanism, First order & Second order. Dependence of temperature on reaction rates. Arrhenius theory, collision theory, Transition – state theory, Physical adsorption, chemisorption, Freundlich's expression, Langmuir adsorption isotherm, Heterogeneous catalysis, examples of heterogeneously catalysed reactions. Features of Coordination Chemistry & Organic Reaction Mechanism: Coordination chemistry, coordination number, chelate effect, coordination complexes and their applications. Electrophilic substitution reactions in aromatic systems. Some Name reactions viz. Hoffman's rearrangement, Beckman's reaction, Riemer-Tiemann reaction, Skraup synthesis, etc. Thermodynamics and electrochemical Phenomenon, Analytical aspects of water, Engineering Materials, Interaction of radiation with matter.

ENT-113 Engineering Drawing

Mechanical Drawing: Use of drafting instruments. Basic drafting techniques, drawing and lettering, dimensioning, projections and section of solids, orthographic projections, isometric views with reference to piping and ducting, practice of assembly drawing. Civil drawing: plan, elevations (front, left and right) and details of buildings. Elements of perspective drawings. Electrical Drawing: Electrical safety drawings, electric substation equipment layout, schematic diagrams of substations, lighting, and power distribution boards in contrast with house and industrial wiring diagrams, electrical symbols and one-line diagrams of a typical power system and its parts using all details. The CAD tools will also be introduced to students for familiarization with Computer Aided Designing such as AutoCAD, ProE or any other similar software.

ENH-123 Communication Skills

Vocabulary building, common writing errors, purposeful writing, business writing, critical reading, reading for understanding, introduction to communication process, seven Cs of communication, types of listening, listening skills, verbal and non-verbal communication, basic presentation skills, Presentation Strategies and public speaking skills, use of Audio-Visual Aids, basics of group communication, communicate effectively in job interviews.

ENH-132 Pak Studies

Pakistan ideology: Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah, Aims and objective of the creation of Pakistan. Indus Civilization, Location and Geo-Physical features, Reformist Movement in Subcontinent. Muslim League 1906, Lahore Resolution 1940, 3rd June plan and Independence 1947, Constitution and Law, Constitutional Assembly, Nature and Structure of Constitution, Features of 1956, 1973 Constitutions. Amendments in the Constitution (17th, 18th, 19th and 20th), Foreign Policy, Objectives, Contemporary Pakistan, Economic institutions and issues, Society and social structure, Ethnicity, Determinants of Pakistan Foreign Policy and challenges, Futuristic stance of Pakistan.

ENS-153 Applied Mathematics-II

Differential equation; basic concepts and ideas; geometrical interpretation of first and second order differential equations; separable equations, equations reducible to separable form, exact differential equations, integrated factors. Linear first order differential equations, Bernoulli's differential equation. Families of curves, orthogonal trajectories and applications of differential equations of first order to relevant engineering systems. Homogeneous linear differential equations of second order, homogeneous equations with constant coefficients, the general solutions, initial and boundary value problems, D-operator, complementary functions and particular integrals. Real, complex and repeated roots of characteristics equations. Cauchy equation, non-homogeneous linear equations. Applications of higher

order linear differential equations. Ordinary and regular points and corresponding series solutions; introduction to Laplace transformation.

ENS-163 Computer Programming

Introduction to the course, C++ and the IDE. Data types and operators. Functions. Conditions (if, if-else, nested ifelse). Conditions (switch statement, conditional operator). Recursion. Iteration (for loop, while, do-while). Iteration (do-while). Strings. File handling Structures. Arrays, Sorting Arrays and passing arrays to functions. Pointers. Calling functions by reference. Introduction to classes and objects.

ENT-123 Introduction to Energy Engineering Technology

Word and Pakistan Energy Scenario, Types of Renewable Energy Technologies, Classifications of wind and solar system's best locations for Solar and wind Energy systems. Designing of Wind and Solar Energy systems, Weibull probability distribution and TSR Speed-Power relations and designing of blades, Power vs speed Blade designing. Designing of Solar System Designing of parameters for maximum efficiency of solar systems, Types of solar cells and losses, Design of parameters for a high efficiency solar cell, Heterojunction, thin films, and other promising solar cells. Costing of Renewable Energy Systems, Capital cost of system, Payback period, Maintenance Cost. Grid Connected Systems: Exploitation of Alternate energy sources, Review of present energy state of energy sector, Different sources of energy, Components of power systems, Energy crises. Problems in energy sector: WAPDA's Plan, Short term, and long-term measures. Distributed generation Resources and their economics: Fossil fuels, Tidal, Ideal, and practical values, Demand charges, Electricity utility rates.

ENT-131L Workshop Practice

This lab aims to impart the students hands-on experience on different equipment in workshops. Besides giving them insight about machines operations, and tools utilizations, similarly wood working technology, tools and applications for pattern making. Understanding and applications of different measuring and gauging instruments. Performing foundry operations such as forging and casting. Hands-on joining operations such as different welding processes, fastening, riveting and adhesive bonding. Basics of lathe & milling operations, drillings and cutting etc.

ENT-213 Introduction to Occupational Safety Health Environment

Introduction & objectives of Safety, Importance of Safety in an industry, Industrial accidents, Types of accidents, Effects of accidents, Green House Gases, Global Warming. Principles of accident prevention: Hazards and its types, Risk, Sources of Risk, Risk Assessment, Risk Matrix, Personal Protection Equipment (PPEs), Safety Management and Hierarchy of Control, Safety training, First aid and emergency procedures. Fire Safety: Chemistry of Fire, Fire Triangle, Types of Fire, Fire prevention and control, Fire Extinguishers, PASS rule for Fire Extinguishers. Environmental Acts: Legal, humanitarian and economic reason for action, Pakistan Health and Safety Act, OHSAS 18001, Environmental Management system ISO 14001, ISO Standards for Safety, Health and Environment Pollution and its Types: Atmospheric Pollution & types of Atmospheric pollution, Causes and Effects of Atmospheric Pollution on Human Health Available Technologies for Controlling Pollution, Industrial Waste, Solid Waste, Industrial Effluents and Waste Gases, Waste treatment plants, Noise Pollution, Measurement of Noise level, Effect of excessive noise on human health, Remedial Measures.

ENT-223 Fuel Technology-1

Introduces and basic knowledge about solid, liquid and gaseous fuels, Various fuels origin, classification and preparation procedure, Fuel characterization in terms of physio-chemical properties, Coal mining, cleaning and its combustion processes, Petroleum exploration and evaluation, Petroleum distillation and

secondary processing, Gaseous fuels, Combustion of various fuels, Combustion in the light of thermodynamics, Various combustion appliances, Combustion in the light of Mathematics, Combustion and Environment, Pollution, Clean fuels techniques, Bio fuels.

ENT-233 Introduction to Engineering Materials

The concept of stress and strains under direct and transverse loading conditions. Stress-strain diagram, poisson's ratio, Factor of safety. Understand the Mechanical properties of Different materials under various loading conditions. Failure due to axial loading in beams, bars, columns etc. Description of strength, resilience, toughness, and fracture under tensile and compressive loadings. Concept of area moment of inertia and polar mode of inertia. Torsion, design of shaft and its failure due to torsional loads. Determination of bending stresses and deflection in different types of beams under various loading conditions.

ENT-243 Energy Instrumentation and Measurement

Precision measurements terminologies principles of different measurement techniques; instruments for measurement of different types of energy including electrical, mechanical, and chemical etc.; Voltmeter design, ammeter design, construction and working of different bridges, measuring instruments, and recording instruments, signal generators, Sensors, Input and output transducers; types of bridges for measurement of resistance, inductance, and capacitance; power and energy meters etc.

ENT-253 Power Electronics

Introduction and Basic concepts of Power Electronic. Principles of power electronics, circuit components and their effects, merits and demerits, power losses in a real switch, control aspect types of converters and applications, AC to DC converters. Rectifiers with resistive and inductive loads, Un-controlled, semi controlled and fully controlled rectifiers, Three-phase rectifiers: un-controlled, semi controlled and full controlled, six-pulse and twelve-pulse, PWM converters, Converters, Buck converter, boost converter and Buck-boost converters, isolated converters, forward converters, flyback converters Inverters, types, method of voltage control, cycloconverter switching mode power supplies static switches.

ENT-263 Fundamentals of Electrical Technology

D.C Fundamentals, A.C Fundamentals, Current, voltage, resistance, Ohm's law, series and parallel circuits, effect of temperature on resistance, resistivity, work, power, energy, inductance, magnetic circuits, Faraday's laws of electromagnetic induction, Fleming's right hand rule, Lenz's law, production of electromotive force (e.m.f), dynamically and statically induced e.m.f's, self-induced e.m.f and mutual induction, capacitors, capacitance, capacitance in series & parallel circuits, types, charging and discharging of capacitors. D.C Generator, D.C Motor, D.C Servomotor, Induction Motor, Single-phase Motor, Transformer, Alternator, Synchronous Motor

ENH-213 Technical Report Writing

Introduction to technical writing, technical communication process, proposal write-up and improvement strategies, introduction to research and research types, choosing research problems and research advisors, how to carry out research, different parts of technical writing, formulation – problem statement, literature review, design –methodology, analysis - data analysis and interpretation good writing style techniques, uses of correct words, presenting and publishing research, write business/professional correspondence, cover letter and CV, writing meeting minutes, introduction to informal writing, uses of informal reports.

ENT-273 Electrical Power Transmission and Distribution

Transmission Lines: Purpose of transmission, choice of frequency and voltage, parameters of overhead transmission lines, types and calculations of transmission lines. Ferranti, corona, and skin effects on transmission lines. Mechanical Design Of Overhead Lines: Line supports, sag and tension calculations, effect of wind pressure and ice loading, conductor vibration and use of dampers. Insulators: Insulator material, types of insulators, voltage distribution over insulator string, string efficiency, methods of improving the string efficiency, testing of insulators. DC AND AC Distributors: Pointed and uniform AC and DC distributors, distributors fed at one and both ends, ring mains, stepped mains, unbalanced loading of three phase AC distributors. Underground Cables: Cable resistance, inductance and capacitance, methods of cable installation, voltage drop and power loss, types of cables used in industries, cable fault localization. STATIC SUBSTATION: Substation location and layout, classification of substations, bus bar arrangement, grounding of star neutral point.

ENT-283 Electrical Machines

DC Motors: Introduction and fundamental concepts, working principle, types, construction, operation, EMF equations, torque equations, characteristics, commutation, armature reaction, speed and voltage regulation, losses, open and short circuit test, no load and blocked rotor test, nameplate ratings and applications. Transformers: Introduction and fundamental concepts, working principle, types, construction, ideal transformer, operation and equivalent circuit, voltage regulation, losses, open and short circuit test, efficiency, instrument and auto transformers, nameplate ratings and applications. Induction and Synchronous Machines: Introduction and fundamental concepts, working principle, rotating magnetic field, magneto motive force and flux distribution, types, construction, operation, EMF equations, torque equations, speed and voltage regulation, losses, open and short circuit test, no load and blocked rotor test, nameplate ratings and applications. Fractional-Horsepower Motors: Hysteresis Motors, Stepper Motors, Universal Motors, Brushless DC Motors, etc.

ENT-293 Power System Analysis and Control

Representation of Power Systems: One-line diagram, impedance and reactance diagram, percent or per-unit quantities, selection of base and change in base of p.u. quantities, per unit representation of single-phase transformer, per unit reactance diagram of a power system, per unit impedances of three winding transformers. Symmetrical Three Phase Faults: Symmetrical three phase faults on an unloaded synchronous machine, short circuit currents and reactance of synchronous machines, internal voltages of loaded machines under transient conditions, fault calculation and numerical problems. Symmetrical components: Symmetrical components of unsymmetrical phasors, power in terms of symmetrical components; sequence networks, positive, negative and zero sequence networks, unsymmetrical series impedances. Unsymmetrical faults: Unsymmetrical faults on unloaded generators, unsymmetrical faults on power systems; single line-to-ground faults; line to-line faults, double line-to-ground faults, double line to line faults; demonstration problems. Power system stability: Steady state and transient stability, swing equation, the power angle equation, equal area criterion of stability and its application, demonstration problems.

ENT-2103 Applied Thermodynamics

Thermodynamic systems, Thermodynamic properties, Laws of Thermodynamics and applications, Energy and work, Properties of vapor and steam, Properties of ideal and real fluid and their relationships, Applications of thermodynamic principles to fluids, Closed and Open systems, Thermodynamics cycles (Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Rankine Cycle, Brayton Cycle) and application, Fuel and Combustion: calorific values, air fuel ratio, chemical equation and conservation of

mass in a combustion process, Nozzles, Diffusers, Compressors and, Steam and Gas turbines, Heat balance sheet for thermal systems.

ENT-2113 Fuel Technology-II

Introduction (Fuels): Classification of Fuels, conventional and non-conventional fuels, characterization of fuels in terms of calorific values, Octane and Cetane values, pour point, flash point etc. Wood: Composition, Combustion Characteristics of Wood, Carbonization of Wood – Wood Charcoal, Bagasse. Peat: Introduction, Types and Composition, Commercial Production of Peat, Combustion Characteristics of Peat, Low-Temperature Carbonization of Peat, Producer Gas from Peat. Coal: Origin of Coal, Classification, Coal Properties and Structure, Coal Structure, Coal Mining, Transportation of Coal, Coal Cleaning, The Use of Coal, Clean Coal Technology, Iron and Steel Production, Use of Coal in Cement Production, Liquid Fuels from Coal, coal processing. Crude Oil: Consumption of Oil, Oil Demand by Sectors, Exploration, Drilling, and Production, Crude Oil Benchmarking, Crude Oil Characterization, Crude Oil Refining. Oil processing techniques. Natural Gas: Formation of Natural Gas, Composition of Natural Gas, Combustion Properties of Natural Gas, Natural Gas Production; Extraction and Processing, Gas-Oil Separation, Oil and Condensate Removal, Dehydration, Glycol Dehydration (Glycol Injection), Oil Absorption Process, Liquefied Natural Gas (LNG) Liquefaction Process, Transportation and Storage of LNG, LNG Storage Facility.

ENM-313 Project Management

History of management, functions and functional areas of management, levels of management, managerial skills, types of organizations, managerial control, principles of management. Introduction to Project Management: Definition of Project and Project Management, knowledge areas of project management, project life cycle, project characteristics, project constraints, project organization structure. Project Quality Management: History of Quality Management, defining quality, relationship between project management and quality management, Quality Management Frameworks. Project Stakeholder Management: The roles of project manager and project sponsor, project team selection, skills, and competencies of project manager, building and managing successful project teams, stakeholder management. Project Cost Estimating and Budgeting: Cost components and methods for cost estimation in projects, cost control in projects, life cycle cost, cost scheduling and forecasting, project resource allocation and levelling, estimation of outstanding work, elements of budgets and estimates, earned value management. Project Risk Management: Defining risk and uncertainty, business and project risk, probability and impact of risk, risk management process. Project Time Management: Introduction to project scheduling, Critical Path Method, network representation of projects, critical activities, and critical path, project Gantt Chart. Project Closure: Project evaluation, project and project management success, success criteria for projects, project audits, project termination process.

ENT-312 Solar Thermal System

Solar radiation measurements: Solar charts; pyrliometer; pyranometer; pyrgeometer; net pyradiometer-sunshine recorder; Heat transfer in solar systems: Energy balance of Flat plate collector; Flat-plate collector performance: incidence angle modifier; thermal test data conversion; design of solar heating systems; passive solar energy systems; Case studies related to active and passive use of solar energy; Design of thermal systems: classification; and performance analysis of various concentrated collectors; Automatic tracking systems; Solar-assisted technologies (solar distillation still, solar cold storage plant; solar cooker; solar bakery system solar roaster etc.) solar process economics; cost of solar process systems; life cycle savings methods; Thermal energy storage: Solar thermal energy storage technologies; Sensible heat storage system; Latent heat storage system; Sorption and thermochemical heat storage system; Metal hydride based solar thermal energy storage reactor; Energy and Exergy Analyses; Numerical

Modeling and Simulation; Thermal Management with Phase Change Materials; System operation and application.

ENT-323 Wind Turbine Technology

Historical uses of wind, Horizontal and Vertical axis wind turbines, Innovative wind turbines, Wind farms, Wind Characteristics, Meteorology of wind, Weibull statistics model, Wind Measurements, Wind Turbine Power, Energy, Torque, Blade aerodynamics, Transmission and generator efficiencies, Energy production and capacity factor, Turbine shaft power and torque at fixed and variable speeds, Wind turbine mathematical models, Mechanical components of wind turbines - Rotor, Blade, The Hub, Drive train, Couplings, Gearbox, Brakes, Yaw system, Main frame and nacelle, Tower, Mechanical Aerodynamic and Electrical subsystem, Pitch subsystem, Power quality, Turbine modes of operation, Turbine control strategies, Grid Integration of offshore wind farms, HVAC, Economics and Environmental Aspects of Wind Systems.

ENT-333 Geothermal System and Biomass

Geothermal Energy (resources, heat and electricity applications) Geothermal Energy Nature of fields, Earth structure, Classification of Geothermal Resources , Introduction to geothermal steam electric plants, Liquid Dominated System: Flashed Steam System, Total Flow Concept, Geothermal exploration, Geothermal power and heat generation turbines. Geothermal environmental impacts, Geothermal well drilling, geothermal reservoir engineering, geothermal electric power plants. Single flash steam power plants, geo-fluid gathering system, piping layout, flashing process, separation processes. Double flash power plants, dry-steam power plants, binary cycle power plants. Ocean as a source of energy, types of ocean energy, wave energy, wave energy conversion systems. Hinged contour wave energy converters, Pelamis wave power system, Energy from ocean currents, marine turbine. Tidal energy conversion system, seawater impoundment.

ENT-343 Power Protection and Maintenance

Structure & Growth of Electrical Power Systems, Evolution of Modern Power System, Basic Power Definition and units, Importance of Power Protection, needs and applications Reasons for protections, Relays its types, Attributes of Power System, Faults and their Types, Symmetrical Fault Analysis (SFA), Unsymmetrical Fault Analysis (UFA), Symmetrical Components, Sequence Impedances, Sequence Networks of Loaded Generator, Line-to-Ground (L-G) fault, Line-to-Line (L-L) Fault and Line-to-Line-Ground (L-L) Fault analysis of unloaded generator and Power system, Circuit breakers, Protective Relays, Instrument Transformers, Overcurrent Protection, Differential Protection, Earth Leakage Protection, Protection of Transformers. Generators and Transmission Lines, Circuit Breakers and Switchgears, Fuses, Circuit interruption, Circuit Breaker-Types.

ENT-353 Energy Audit and Management

The students will learn about energy audit process, economic analysis and life cycle, energy use in various industrial sectors and buildings, energy efficiency potentials in industry and buildings, and barriers to energy efficiency, managing energy efficiency in industry and buildings, barriers to energy efficiency from a sociotechnical perspective of energy efficiency. They will learn to use their understanding of these concepts in estimating energy consumption and impact of building design on energy performance. Lighting techniques – Natural, Compact Fluorescent Lamps (CFL), Light Emitting Diodes (LED) lighting sources and fittings, Calculation and costing of proposed energy conservation measure, Depreciation cost, sinking fund method. Cost evaluation by Return on Investment (ROI) and pay back method, Risk Analysis, Case study, Energy audit and its benefits, Energy flow diagram, Preliminary and detailed energy audit, Methodology of preliminary energy audit and detailed energy audit, ISO 50001, Energy audit report, Introduction to tools required for energy auditing, Tools for energy audit.

ENT-363 Photovoltaics

Semiconductor properties: Fermi-Dirac distribution function and location of fermi-level in doped semiconductor; Dynamics and densities of electrons and holes; Carrier transport mechanism: Interaction of light with semiconductor; Bandgap-to-bandgap processes; Generation and recombination of electron-hole pairs; Minority carrier lifetime; Poisson's Equation; Current density and continuity equations; P-N junction: Characteristics under darkness and illumination; Solar cell parameters and equivalent circuit; Parameter affecting the solar cell performance, Study of thin film deposition techniques, Standard and improved silicon solar cell manufacturing technology; High-efficiency concepts based on crystalline silicon technology; Hetero and multi-junction solar cell; Measurement and monitoring: Solar PV system components; Solar charge controllers; Types; Characteristics; Solar inverters type and characteristics; Solar cables; Solar mounting system; Solar PV system types; Solar PV off grid; Hybrid and on grid systems;

ENT-373 Power Quality

General Classes of Power Quality Problems, Transients, Long Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance, Waveform Distortion, Voltage Fluctuations, Power Frequency Variations, Power Quality Terms. Sources of Sags and Interruptions, Estimating Voltage Sag Performance, Fundamental Principles of Protection, Solutions at the End-User Level, Evaluating the Economics of Different Ride-Through Alternatives, Motor Starting Sags, Utility System Fault-Clearing Issues. : Sources of Transient Over Voltages, Principle of Over Voltage Protection, Devices for Over Voltage Protection, Utility Capacitor-Switching Transients, Utility System Lightning Protection, Managing Ferro-resonance, Switching Transient Problems with Loads, Computer Tools for Transient Analysis. Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quantities under Non-sinusoidal Conditions.

ENT-383 Fluid Dynamics and Hydrodynamics Machinery

Fluid Properties: Introduction, Fluid, Units and Dimensions, Density, Specific Volume, Specific Weight, Specific Gravity, Viscosity, Vapor Pressure, Surface Tension, Capillary Action and Compressibility of Fluids. Fluid Statics: Pressure at a Point, Pressure Variation in a Static Fluid, Hydrostatic Paradox, Aerostatic Law, Standard Atmosphere, Absolute Pressure, Gauge Pressure, Vacuum Pressure, Barometer, Pressure Measuring Devices. Fluid Kinematics: Methods Describing Motion of Particles, Types of Fluid Flow, Equation of Continuity, Flow Visualization, Velocity and Acceleration, Velocity Potential, Stream Function, Flow Net. Fluid Dynamics: Euler's Equation of Motion, Bernoulli's Equation, Bernoulli's Equation for Real Fluids, Venturimeter, Orifice meter, Pitot Tube, Nozzle Meter, Free Liquid Jet, Impulse Momentum Equation, Moment of Momentum Equation, Forced Vertex, Free Vertex

ENT-393 Heating, Ventilation and Air Conditioning System

Fundamentals of refrigeration cycles: Vapour Compression cycle, Vapour Absorption cycle, Types of Refrigerants, Refrigeration components and controls, Psychrometry, Air Conditioning Systems; Air Conditioning Equipment, components and controls, Duct Systems, Fans and Air Distribution Systems, Indoor Air Quality, Heating and Cooling Load Calculations, Energy efficient buildings, Automotive air conditioning system, Maintenance and Repair of Domestic and Commercial Equipment: maintenance of a new installation-sample scheduling, Types of air compressors, Compressor efficiency and operation, Capacity assessment, Leakage test, Factors affecting the performance and efficiency, compressor repair and checking the efficiency, Pneumatics, pneumatic control, descaling of condenser, purging or removing air from system; Refrigeration and Air conditioning Tools: List of tools and their applications, safety precautions, Fans and blowers.