



ME 605 REFRIGERATION & AIR CONDITIONING

Unit-I

Introduction: Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle, Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Unit-II

Vapour compression system: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on COP; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

Unit-III

(a) **Vapour absorption system:** Theoretical and practical systems such as aqua-ammonia, electrolux & other systems; (b) **Steam jet refrigeration:** Principles and working, simple cycle of operation, description and working of simple system, (c) **refrigerants:** nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties.

Unit-IV

Psychrometric: Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,

Unit-V

Air conditioning loads: calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

References:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI



6. Pita ; Air conditioning Principles and systems: an energy approach; PHI
7. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
8. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA
9. Arora RC; Refrigeration and Air conditioning; PHI Learning

List of Experiments

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant
3. General Study and working of cold storage
4. General Study Trane Air Condition (Package Type).
5. General Study of Electrolux Refrigeration
6. General Study One tone Thermax refrigeration unit.
7. General Study of Water cooler
8. General Study of Psychrometers (Absorption type)
9. General Study of Leak Detectors (Halide Torch).
10. General Study and working of Gas charging Rig.
11. General Study of window Air Conditioner.
12. General Study and working of Vapor compression Air conditioning Test rig.
13. Experimentation on Cold Storage of Calculate COP & Heat Loss.
14. Experimentation on Vapor compression Air Conditioning test rig.
15. Changing of Refrigerant by using Gas Charging Kit.



ME 601 POWER PLANT ENGG.

Unit I:

Introduction to methods of converting various energy sources to electric power, direct conversion methods renewable energy sources, solar, wind, tidal, geothermal, bio-thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter.

Unit II:

Fossil fuel steam stations: Basic principles of siting and station design, effect of climatic factors on station and equipment design, choice of steam cycle and main equipment, recent trends in turbine and boiler sizes and steam conditions, plant design and layout, outdoor and indoor plant, system components, fuel handling, burning systems, element of feed water treatment plant, condensing plant and circulating water systems, cooling towers, turbine room and auxiliary plant equipment., instrumentation, testing and plant heat balance.

Unit III:

Nuclear Power Station: Importance of nuclear power development in the world and Indian context, Review of atomic structure and radio activity, binding energy concept, fission and fusion reaction, fissionable and fertile materials, thermal neutron fission, important nuclear fuels, moderators and coolants, their relative merits, thermal and fast breeder reactors, principles of reactor control, safety and reliability features.

Unit IV:

Hydro-Power Station: Elements of Hydrological computations, rainfall run off, flow and power duration curves, mass curves, storage capacity, salient features of various types of hydro stations, component such as dams, spillways, intake systems, head works, pressure tunnels, penstocks, reservoir, balancing reservoirs, Micro and pico hydro machines, selection of hydraulic turbines for power stations, selection of site.

Unit V:

Power Station Economics: Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor and their influence on plant design, operation and economics; comparison of hydro and nuclear power plants typical cost structures, simple problems on cost analysis, economic performance and tariffs, interconnected system and their advantages, elements of load dispatch in interconnected systems.

References:

- 1- Nag PK; Power plant Engg; TMH
- 2- Al-Wakil MM; Power plant Technology; TMH
- 3- Sharma PC; Power plant Engg; Kataria and sons, delhi
- 4- Domkundwar; Power Plant Engg; Dhanpatrai & sons.
- 5- Rajput RK; A text book of Power plant Engg.; Laxmi Publications.
- 6- Yadav R; Steam and gas turbine and power plant engg by



ME 602 MANUFACTURING PROCESS-II

Unit I:

Lathe: Classification of machine tools and their basic components; lathe- specification, components & accessories, various operations on lathes, capstan & turret lathes, tool layout, methods of thread production, machining time, single point cutting tools, tool signature and nomenclature

Unit II:

Grinding: Types of grinding machines, surface, cylindrical and internal grinding, grinding wheels, specifications, wheel turning and dressing without eccentricity, centre-less grinding.

Unit III:

Milling: Vertical, horizontal and universal type machines, specifications and classifications of milling machines, universal dividing head plain and different indexing, gear cutting, milling cutters. **Drilling & Broaching:** Fixed spindle, radial and universal drilling machines, drilling time, broaching principle, broaches and broaching machines.

Unit IV:

Shapers: Classification and specifications, principle parts, quick return mechanism, shaper operations, speed feed, depth of cut, machining time. Surface qualities, equipment used for rating surfaces, rms. CLA value, causes for surface irregularities.

Gear Cutting: Die casting, methods of forming gears, generating process, Gear shaping, gear shaving, gear grinding gear testing.

Unit V:

Mechatronics: Introduction to control systems, analog control, transfer function, procedure for writing transfer function, signal flow diagram, introduction to electronic components like switches, magnetic type, electromagnetic type, transducers and other sensors, servo motors, basics of CD-ROM players, PLC, applications, CNC machines.

References:

1. Boston; Metal Processing.
2. Hazra Chadhary; Workshop Tech.II
3. Lindberg – Materials & Processes of Manufacture.
4. Work shop technology by Raghuvanshi-Vol-II
5. Production Processes by HMT

List of Experiment

To make a complicate job on lathe machine with all operations like turning, step turning, drilling , taper turning , thread cutting and knurling .

1. Study of center less grinding machine/ tool and cutter type grinding machine.
2. Study of horizontal/ universal milling machine, diving head and indexing mechanism of it.
3. To cut a spur gear on milling machine using rapid indexing method.
4. Study of radial drilling machine and preparing a job on it.
5. To study a sapping machine to learn about working of quick return mechanism.



ME 603 I.C. ENGINE

Unit I: I

Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines, valve timing.

Unit II:

Combustion in SI engines: Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects of detonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels, octane number, H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features of various type combustion chambers, valve timing and firing order.

Unit III:

Combustion in C.I. Engines: Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, octane number, knock inhibitors, salient features of various types of combustion chambers, fuel, ignition, cooling, exhaust and lubrication systems; Simple problems on fuel injection, various types of engines, their classification and salient features. Rotary I. C. engines, their principles of working.

Unit IV:

I.C. Engine System: Fuels, ignition systems, cooling, exhaust/scavenging and lubrication system. Fuel metering in SI engine: Fuel injection in SI engine (MPFI & TBI), Theory of carburetion, simple problems on carburetion. Fuel metering in CI engines: Fuel injection in CI engine and simple problems, various types of engines, their classification and salient features.

Fuels: Conventional fuels and alternate fuels, engine exhaust emission, carbon monoxide, un-burnt hydro carbon, oxides of nitrogen, smoke, density, measurement and control, hydrogen as alternate fuel.

Unit V:

Supercharging: Effect of attitude on mixture strength and output of S.I. engines, low and high pressure super charging, exhaust, gas turbo-charging, supercharging of two stroke engines. **References:**

1. A. Course in IC engines by M.L. Mathur & R.P. Sharma
2. Internal Combustion engines by V. Ganeshan
3. Internal Combustion Engines Theory & Practice by G.F. Taylor
4. Introduction to IC Engines by Richard Stone.
5. Internal Combustion Engines by DomKundwar Dhanpat rai Publications .

Suggested List of Experiments

Determination of Valve timing diagram

1. Load test on Petrol Engine
2. Heat Balance of SI engine
3. Heat Balance of CI Engine
4. Study of Battery Ignition system and Electronic Ignition System
5. Study of Diesel fuel pump
6. Study of Diesel fuel injectors
7. Study of a Carburetors
8. Study of Fuel Injection system in SI Engine
9. Study of lubricating system in CI Engines
- 10.



ME 606 COMPUTER AIDED ENGG.

Unit 1

Methods to solve engineering problems- analytical, numerical, experimental, their merits and comparison, discretization into smaller elements and effect of size/ shape on accuracy, importance of meshing, boundary conditions, Computer Aided Engineering (CAE) and design, chain-bumping-stages vs concurrent-collaborative design cycles, computer as enabler for concurrent design and Finite Element Method (FEM), degree of freedom (DOF), mechanical systems with mass, damper and spring, stiffness constant K for tensile, bending and torsion; Practical applications of FEA in new design, optimization/ cost-cutting and failure analysis,

Unit 2

Types of analysis in CAE, static (linear/ non linear), dynamic, buckling, thermal, fatigue, crash NVH and CFD, review of normal, shear, torsion, stress-strain; types of forces and moments, tri-axial stresses, moment of inertia, how to do meshing, 1-2-3-d elements and length of elements; force stiffness and displacement matrix, Rayleigh-Ritz and Galerkin FEM; analytical and FEM solution for single rod element and two rod assembly.

Unit 3

Two-dimension meshing and elements for sheet work and thin shells, effect of mesh density and biasing in critical region, comparison between tria and quad elements, quality checks, jacobian, distortion, stretch, free edge, duplicate node and shell normal.

Unit 4

Three-dimension meshing and elements, only 3 DOF, algorithm for tria to tetra conversion, floating and fixed trias, quality checks for tetra meshing, brick meshing and quality checks, special elements and techniques, introduction to weld, bolt, bearing and shrink fit simulations, CAE and test data correlations, post processing techniques.

Unit 5

Review of linear optimization, process and product optimization, design for manufacturing (DFM) aspects in product development, use of morphing technique in FEA, classical design for infinite life and design for warranty life, warranty yard meetings and functional roles, climatic conditions and design abuses, case studies.

References:

- 1.Gokhle Nitin; et al; Practical Finite Element Analysis; Finite to Infinite, 686 Budhwar Peth, Pune.
- 2.Krishnamoorthy; Finite Element Analysis, theory and programming; TMH
- 3.Buchanan; Finite Element Analysis; Schaum series; TMH
- 4.Seshu P; Textbook of Finite Element Analysis; PHI.
- 5.Desai Chandrakant S et al; Introduction to finite element Method ,
- 6.Zienkiewicz; The finite element Method; TMH
- 7.Reddy an introduction to finite element method; TMH
- 8.Martin and Graham; Introduction to finite element Analysis (Theory and App.)



ME 604 MECHANICAL VIBRATION & NOISE ENGG.

Unit 1:

Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems.

Undamped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: the compound pendulum.

Unit 2:

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

Unit 3:

Harmonically excited Vibration: One degree of freedom- forced harmonic vibration; vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments).

Whirling Motion and Critical Speed : Whirling motion and Critical speed : Definitions and significance .Critical – speed of a vertical , light – flexible shaft with single rotor : with and without damping .Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

Unit 4:

Systems With Two Degrees of Freedom : Un-damped free vibration of 2 d.o.f and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation ; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

Unit 5: Noise Engineering – Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipments; hearing conservation and damage risk criteria, daily noise doze.



Noise: Sources, Isolation and Control: Major sources of noise on road and in industries, noise due to construction equipments and domestic appliances, industrial noise control, strategies-noise control at source (with or without sound enclosures), noise control along the path (with or without partitions and acoustic barriers); noise control at the receiver, ear defenders, earplugs, semi-insert protectors.

References:

- 1- Ambekar A.G., ' Mechanical Vibrations and Noise Engineering; PHI
- 2- Meirovitch Leonard; Element of Vibration Analysis; TMH
- 3- Dukikipati RV Srinivas J Text book of Mechanical Vibrations; PHI
- 4- Kelly SG and kudari SK; Mechanical Vibrations; Schaum Series;TMH
- 5- Thomson , W.T., Theory of Vibration with Applications , C.B.S Pub & distributors .
- 6- Singiresu Rao, ' Mechanical Vibrations ' , Pearson Education .
- 7- G.K. Grover, ' Mechanical Vibration , Nem chand and Bross , Roorkee

List of experiments

- 1- To find out effect of load on natural frequency of vibrations of a lever pin supported at one end carrying adjustable load on a vertical screwed bar and spring supported at some intermediate point (i) When the dead weight of rods is neglected and (ii) when their dead weight is taken into account .
- 2- To find out frequency of damped free vibration and rate of decay of vibration-amplitude in the system.
- 3- To find out natural frequency and damped free frequency of a torsion pendulum and , hence to find out coefficient of damping of the oil ;