SPPU B.E./B.Tech MECH Sem 8 syllabus

Energy Engineering

Course Code : 402047 Course Name : Energy Engineering

Credits 04

Unit 1: Introduction and Thermal Power Plant 6 Hrs

A) Power Generation : global scenario, present status of power generation in India, in Maharashtra, Role of private and governmental organizations, load shedding, carbon credits, pitfalls in power reforms, concept of cascade efficiency.
B) Thermal Power Plant : General layout of modern thermal power plant with different circuits, site selection criteria, classification of coal, coal blending, coal beneficiation, selection of coal for thermal power plant, slurry type fuels, pulverized fuel handling systems, fuel burning methods, FBC systems, high pressure boilers, ash handling system, Rankine cycle with reheat and regeneration (Numerical Treatment), steam power plants with process heating (Numerical Treatment)

Unit 2: Steam Condenser and Environmental Impacts of Thermal Power Plant 6 Hrs

A) Steam Condenser : Necessity of steam condenser, elements of steam condensing plant, classification, cooling water requirements, condenser efficiency, vacuum efficiency (Numerical Treatment), cooling towers, air leakage and its effects on condenser performance, air pumps (Numerical Treatment for Air Pump capacity)
B) Environmental impact of thermal power plants : Different pollutants from thermal power plants, their effects on human health and vegetation, methods to control pollutants such as particulate matter; oxides of sulphur; oxides of nitrogen, dust handling systems, ESP, scrubbers, water pollution, thermal pollution, noise pollution from TPP and its control

Unit 3: Hydroelectric and Nuclear Power Plant 6 Hrs

A) Hydroelectric Power Plant : site selection, classification of HEPP (based on head, nature of load, water quantity), criteria for turbine selection, dams, spillways, surge tank and forebay, advantages and disadvantages of HEPP, hydrograph ,flow duration curve ,mass curve, (Numerical Treatment) environmental impacts of HEPP
B) Nuclear Power Plants : elements of NPP, types of nuclear reactor (PWR, BWR, CANDU, GCR, LMCR, OMCR, fast breeder, fusion), material for nuclear fuel, cladding, coolants, control rod and shielding, nuclear waste disposal, environmental impacts of NPP

Unit 4: Diesel and Gas Turbine Power plant 6 Hrs
A) Diesel Power Plants : applications, components of DPP, different systems of DPP, plant layout, performance of DPP (Numerical Treatment) advantages & disadvantages of diesel power plant, environmental impacts of DPP

B) Gas Turbine Power Plant : general layout of GTPP, components of GTPP, open, closed & semi- closed cycle gas turbine plant, Brayton cycle analysis for thermal efficiency, work ratio, maximum & optimum pressure ratio, methods to improve thermal efficiency of GTPP: inter-cooling; reheating & regeneration cycle (numerical treatment), gas and steam turbine combined cycle plant, environmental impacts of GTPP

Unit 5: Non-Conventional Power Plants 6 Hrs
Solar Power Plant based on: flat plate collector, solar ponds, parabolic solar collector, heliostat, solar
chimney, SPV cell based plants: working principal, solar photovoltaic systems, applications Geothermal Plant: superheated steam system, flash type, binary cycle plant.
Tidal Power Plant: components, single basin, double basin systems.
OTEC Plant: principal of working, Claude cycle, Anderson Cycle.
MHD Power Generation : Principal of working, Open Cycle MHD generator, closed cycle MHD
generators. Fuel cell : alkaline, acidic, proton-exchange membrane
Wind Power Plant : wind availability, wind mills and subsystems, classification of wind turbines, operating characteristics, wind solar hybrid power plants, challenges in commercialization of non-conventional power plants, environmental impacts of NCPP Faculty of Science and Technology Mechanical Engineering Page 37 of 62

Unit 6: Instrumentation and Economics of Power Plant 6 Hrs
A) Power Plant Instruments : layout of electrical equipment, generator, exciter, generator cooling, short circuits & limiting

methods, switch gear, circuit breaker, power transformers, methods of earthling, protective devices & control system used in power plants, measurement of high voltage, current and power, control room
B) Economics of Power Generation : cost of electric energy, fixed and operating cost [methods to determine depreciation cost] (Numerical Treatment), selection and type of generation, selection of generation equipment , load curves, performance and operation characteristics of power plants, load division, all terms related to fluctuating load plant (Numerical Treatment)

Books

Text :

1. Domkundwar & Arora, Power Plant Engineering, Dhanpat Rai & Sons, New Delhi
2. Domkundwar & Domkundwar- Solar Energy and Non-Conventional Sources of Energy, Dhanpat Rai& Sons, New Delhi.
3. R.K.Rajput, Power Plant Engineering?, Laxmi Publications New Delhi.
4. D.K.Chavan & G.K.Phatak, Power Plant Engineering?, Standard Book House, New Delhi.

References :

1. E.I.Wakil, Power Plant Engineering?, McGraw Hill Publications New Delhi
2. P.K.Nag, Power Plant Engineering?, McGraw Hill Publications New Delhi.
3. R.Yadav , Steam and Gas Turbines? ,Central Publishing House, Allahabad.
4. G.D.Rai, Non-Conventional Energy Sources, Khanna Publishers,Delhi
5. S.P.Sukhatme, Solar Energy? Tata McGraw-Hill Publications, New Delhi
6. G R Nagpal Power Plant Engineering , Khanna Publication

Mechanical System Design

Course Code : 402048 Course Name : Mechanical System Design

Credits TH : 04 TW : 01

Unit 1: Design of Machine Tool Gear Box 8 Hrs

Introduction to machine tool gearboxes, design and its applications, basic considerations in design of drives, determination of variable speed range, graphical representation of speed and structure diagram, ray diagram, selection of optimum ray diagram, gearing diagram, deviation diagram. (Note: Full design problem to be restricted up to 2 Stages only)

Unit 2: Statistical Consideration in Design 8 Hrs
Frequency distribution-Histogram and frequency polygon, normal distribution - units of central tendency and dispersion- standard deviation - population combinations - design for natural tolerances - design for assembly - statistical analysis of tolerances, mechanical reliability and factor of safety.

Unit 3: Design of Belt Conveyor System for Material Handling 8 Hrs
System concept, basic principles, objectives of material handling system, unit load and containerization.
Belt conveyors, Flat belt and troughed belt conveyors, capacity of conveyor, rubber covered and fabric ply belts, belt tensions, conveyor pulleys, belt idlers, tension take-up systems, power requirement of horizontal belt conveyors for frictional resistance of idler and pulleys.

Unit 4: Design of Cylinders and Pressure Vessels 8 Hrs
Design of Cylinders: Thin and thick cylinders, Lame's equation, Clavarino’s and Bernie's equations, design of hydraulic and pneumatic cylinders, auto-frettage and compound cylinders,(No Derivation) gasketed joints in cylindrical vessels (No derivation).
Design of Pressure vessel : Modes of failures in pressure vessels, unfired pressure vessels, classification of pressure vessels as per I. 2825 - categories and types of welded joints, weld joint efficiency, stresses induced in pressure vessels, materials for pressure vessel, thickness of cylindrical shells and design of end closures as per code, nozzles and openings in pressure vessels, reinforcement of openings in shell and end closures - area compensation method, types of vessel supports (theoretical treatment only).

Unit 5: Design of I.C. Engine Components 8 Hrs
Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, construction of cylinder liners, design of piston and piston-pins, piston rings, design of connecting rod. Design of crank-shaft and crank-pin, (Theoretical treatment only).

Unit 6: Optimum Design 8 Hrs

Objectives of optimum design, adequate and optimum design, Johnson's Method of optimum design, primary design equations, subsidiary design equations and limit equations, optimum design with normal specifications of simple machine elements- tension bar, transmission shaft and helical spring, Pressure vessel Introduction to redundant specifications (Theoretical treatment).

Books

Text :

1. Bhandari V.B. —Design of Machine Elements‖, Tata McGraw Hill Pub. Co. Ltd.
2. Juvinal R.C, Fundamentals of Machine Components Design, Wiley, India

References :

1. Design Data- P.S.G. College of Technology, Coimbatore.
2. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
3. I.S. 2825: Code for unfired pressure vessels.
4. Shigley J. E. and Mischke C.R., —Mechanical Engineering Design‖, McGraw Hill Pub. Co
5. M. F. Spotts, —Mechanical Design Analysis‖, Prentice Hall Inc.
6. Black P.H. and O. Eugene Adams, —Machine Design‖ McGraw Hill Book Co. Inc.
7. Johnson R.C., —Mechanical Design Synthesis with Optimization Applications‖, Von Nostrand Reynold Pub.
8. S.K. Basu and D. K. Pal, —Design of Machine Tools, Oxford and IBH Pub Co.
9. Rudenko,‖Material Handling Equipment‖, M.I.R. publishers, Moscow
10. P. Kannaiah ,‖Design of Transmission systems‖, SCIETCH Publications Pvt Ltd.
11. Pandy, N. C. and Shah, C. S., Elements of Machine Design, Charotar Publishing House.
12. Mulani, I. G., —Belt Conveyors‖
13. Singiresu S. Rao, Engineering Optimization: Theory and Practice, John Wiley & Sons.
14. M.V. Joshi, Process Equipment Design, Mc-Millan.