MTE-301 Thermal Power Plant Engg.

UNIT 1
Conventional thermal power plants, super-critical power plants and its principles of working, performance curves and flow diagrams. Type of boiler Working and Principle

UNIT 2
Power plant components: Fuel and ash handling, pulverized fuel firing burners, dust handling, fluidized bed combustion. Radiant super heaters and re-heaters, economizer and pre-heaters, combustion and furnace design, boiler water supply and treatment. Drat and arrangement of draft fans, different types of cooling systems, open closed, mixed and dry cooling tower systems, air cooled condensers. Ejector and vacuum pumps, feed heating systems, heaters, evaporators and de-airator, feed line protection, boiler feed pumps, different type of drives for it, steam turbine driven feed pumps.

Unit 3
Plant instrumentation for thermal power plants, need and importance, distributed and centralized, pneumatic and electro-mechanical transducers and controllers, distributed computer control. Piping and insulation: design and layout of ducting for air fuel, gases and pulverized fuels, selection of piping, pipe flexibility analysis, Various control valves and actuators. Insulation optimum thickness and costs.

Unit 4
Installation, commissioning and operation: Preliminary performance checks and acceptance test for various components, heat balance of items and entire plant. Starting loading and normal operation checks, maintenance logging, parallel operations, droop setting, performance analysis, maintenance, safety and pollution controls.

UNIT 5
Plant Management: Preparing specifications and contract documents, guarantee. Training of power plant personnel, safety, and seismic analysis. Purchase and contract for fuel supplies.

Reference Books:
1. Power Plant Engineering, F T Morse
2. Power Plant Engineering, P K Nag
3. Power Plant Engineering, Arora and Domkundwar
4. Power Plant Engineering R.K.Rajput

MTE- 301 (B)COMPUTATIONAL FLUID DYNAMICS

UNIT - I

INTRODUCTION: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT – II

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT - III

FORMULATIONS OF INCOMPRESSIBLE VISCOUS FLOWS: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT - IV

FINITE VOLUME METHOD: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT - **V**

STANDARD VARIATIONAL METHODS: Linear fluid flow problems, steady state problems, Transient problems.

REFERENCES:

1. Computational fluid dynamics/ T. J.C'hung/ Cambridge University press,2002.
2. Text book of fluid dynamics/ **Frank** Choriton/ CBS Publishers & distributors, 1985
3. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
4. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
5. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
6. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
7. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford University

MTE-302 (A) Design of heat Exchangers

UNIT 1

Types of Heat Exchangers, definitions & quantitative relationship, Basic design methods for heat exchanger- Design of shell and tube type heat exchanger, Recent developments in heat exchangers.

UNIT 2

Analytical & Numerical solution Procedures, Fouling factors, Correction factors Computerized methods for design and analysis of heat exchanger. Performance enhancement of heat exchanger, fouling of heat exchanger. Testing, evaluation and maintenance of heat exchanger.

UNIT 3

Thermal & hydraulic design of Commonly used heat exchangers : Double pipe heat exchangers , , condensers, Evaporators, Cooling and dehumidifying coils, Cooling towers, Evaporative condensers , design of air washers , desert coolers .

UNIT 4

Review of mechanical Design, TEMA Codes Materials of Construction , corrosion damage , Testing and inspection . Power plant heat exchanger, heat exchanger for heat recovery at low, medium and high temperatures

UNIT 5

Heat Pipe: Basics & its mathematical model , micro Heat Exchangers. Furnaces, Radiative heat exchangers ,Use of software in heat exchanger design.

Reference Books:

1. Compact Heat Exchangers Kays and London, TMH
2. Heat Exchangers- Thermal Hydraulic fundamentals and design, Kokac, TMH
3. Extended Surface Heat Transfer, D Q Kern, A D Kraus, TMH.
4. Tubular Exchanger Manufacturer Association (TEMA), and other codes.

MTE -302 (B) SOLAR ENERGY TECHNOLOGY

UNIT - I

Introduction – Solar energy option, specialty and potential – Sun – Earth – Solar radiation, beam and diffuse – measurement – estimation of average solar radiation on horizontal and tilted surfaces – problems – applications. Capturing solar radiation – physical principles of collection – types – liquid flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collectors with plane reflectors – cylindrical parabolic collectors – Orientation and tracking – Performance Analysis.

UNIT - II

DESIGN OF SOLAR WATER HEATING SYSTEM AND LAYOUT

Power generation – solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers, concentration ratio.

UNIT - III

THERMAL ENERGY STORAGE: Introduction – Need for – Methods of sensible heat storage using solids and liquids – Packed bed storage – Latent heat storage – working principle – construction – application and limitations.

Other solar devices – stills, air heaters, dryers, Solar Ponds & Solar Refrigeration, active and passive heating systems.

UNIT - IV

DIRECT ENERGY CONVERSION: solid-state principles – semiconductors – solar cells – Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insulation and temperature, losses. Semiconductor properties, energy levels, basic equations. Solar cell, p-n junction, structure. Solar PV power plants. performance – modular construction – applications. conversion efficiencies calculations.

UNIT - V

ECONOMICS: Principles of Economic Analysis .Increase in value creation. Funding and sponsoring facilities, international organizations, national possibilities. Incentives, subsidies and feed-in traffic. – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost based analysis of water heating and photo voltaic .Design of solar PV systems. applications. Present & future sanerio for solar energy.

REFERENCES:

1. Principles of solar engineering/ Kreith and Kerider/Taylor and Franscis/2nd edition
2. Solar energy thermal processes/ Duffie and Beckman/John Wiley & Sons
3. Solar energy: Principles of Thermal Collection and Storage/ Sukhatme/TMH/2nd edition
4. Solar energy/ Garg/TMH
5. Solar energy/ Magal/Mc Graw Hill
6. Solar Thermal Engineering Systems / Tiwari and Suneja/Narosa

MTE – 302 (C) Modelling and Analysis Of I.C. Engine

Unit 1

Basic simulation modeling : Nature of simulation, so the system concept, system environment, continuum and discrete system , system modeling, Types of models like static physical, Dynamic physical and mathematical models, principle and in modeling block building relevance, accuracy and aggregation.

Unit 2

Probability Concept in Simulation: Stochastic variables, discrete and continuum probability function, Measures of probability function, Estimation of means variance, standard deviation.

Unit 3

Actual cycles of Engine operation, their analysis, Use of combustion charts, simulation of engine processes like, suction, compression, evaporation and exhaust. Basic engine operating cycles their analysis and simulation Development of computer programs for these.

Unit 4

Modeling : Modeling of Carburetion and injection process and simulation of these process,development of simple programs for analysis. Results of simulation, simulation of engine trouble shooting.

Unit 5

Fuels and Combustion : Characteristics –Classification-Handling and Storage -Flash and Fire Points.-Calorific Value Determination of CV by Bomb Calorimeter-Proximate and Ultimate Analysis Solid Fuels, Liquid ,Fuels, Gaseous

Reference Books:

1. Simulation modeling and analysis – Averill M. Law, WD Kelton , TMH.
2. System Simulation – Geoffrey Gordon, Prentice Hall
3. Discrete System simulation – Jerry Banks, John S. Carson, PHI.
4. international symposium on fuels and lubricants by Basu ,Published by Tata Mac Graw Hill