MMTP – 301 (A) Computer Aided Design of Thermal System

UNIT 1
Basic Consideration in Design: Formulation of Design problems, conceptual design steps in design process computer aided design material selection.

UNIT 2
Modeling of Thermal System: Types of model, mathematical & Physical modeling Dimensional Analysis Numerical modeling & simulation, simulation of thermal processes Application to casting extrusion, heat treatment, Refrigeration systems, thermal design of heat engine.

UNIT 3
Numerical Modeling & Simulation: Numerical modeling, System simulation, Methods for Numerical Simulation.

UNIT 4
Optimization: Basic Concepts, Objective function, constraints, Mathematical Formulation.

UNIT 5
Optimization Methods: Calculus Method, search method linear & dynamic programming, Geometric Programming Introduction to Genetic Algorithms.

Reference Books:

1. Design of thermal systems by W.F. Stoecker
2. Design of optimization of thermal systems by Yogesh Jaluria
3. Optimization Techniques by Rao
4. Optimization Techniques & Genetic Algorithms by Kalyan Mchan Deb.

MMTP – 301 (B) Engine System Modelling and Analysis

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

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. Seila, Applied Simulation Modeling, Cengage (Thomson)

MMTP – 302 (A) Gas Flow Through Turbo Machines

Unit 1 Fundamental Equations of Steady Flow:
Continuity equation, Equations of Motion, Euler's Equation, Bernoulli's equation, Energy, Stream Function and Velocity Potential,

Unit 2 Potential Flow:
Elementary potential flow, Source, Sink, Vortex and Doublet, Superposition of flow patterns. Flow over immersed bodies. Development of the aerofoil-lift and drag, Kutta- Joukowski Profile, pressure distribution over aerofoil blading.

Unit 3 Viscous Flow:
Incompressible Flow: Laminar Turbulent Flows: Navier's Strokes equation and exact solutions of steady flow problems. Flow through pipes, over flats plates. Laminar and turbulent boundary layers. Dimensional analysis.

Unit 4 Compressible Flow of Gases:
Isentropic and adiabatic flow, Stagnation and critical properties Flow though ducts of constant area, Fanno line and Rayleigh line flows. Fundamental equations and variation in flow properties. Flow with normal shock waves governing equations, Prandtl Meyer and Rankine Hugoniot relations, Strength of a shock wave, Moving normal shock waves.

Unit 5 Cascade Tests:
Fundamental equations of flow through turbo machinery. Radial equilibrium equation. Vortex flow through turbo machines. Losses in turbo machinery. Dimensional analysis of flow through turbo machines. Surging and chocking.

Reference Books:

1. Fundamental of Compressible Flows -Yahya
2. Compressible Fluid Flow -Michel A.Saad
3. Introduction of fluid mechanics -Fox and MC Donald
4. Turbo Machines -A.Valan Arasu
5. Applied Fluid Dynamics Handbook -Robert D.Blevins
6. Int J.of Heat and Mass Transfer -Elsevier Pub

MMTP – 302 (B) Non Conventional Energy Sources

UNIT 1

Introduction: Conventional sources of commercial energy ,estimation of time for which conventional sources will last alternate energy sources .

UNIT 2

The Solar Option: Direct and Indirect applications. Availability of solar radiation energy collection and concentration for photo-thermal application, thermal storage. Introduction to photo-voltaic and thermoelectric conversion .Wind energy .Types of wind mills. Elementary design principles .Ocean thermal energy conversion.

UNIT 3

Biomass Energy : Bio mass as a source of energy .Energy plantation . Production of fuel from wood agricultural and animal waste . Bioconversion process .Bio –gas ,its generation and utilization .

UNIT 4

The nuclear option: Fission and fusion technology fundamentals .Thermal and fast reactor .State of art .Breeder reactor .Prospects and limitations .Economics.

UNIT 5

Geothermal Energy System: Extent of available resources .Heat Transport in geothermal system .Introduction to tidal and wave energy .M.H.D. Power .Fuel cells .

UNIT 6

Biochemical Engineering : Introduction to chemicals of life enzymes , kinetics and michaelis–Menten equation .Introduction to microorganisms growth requirements, growth Kinetics ,Monod equation.

Reference Books :

1. Solar Engineering of Thermal Processes , J.A. Duffie and W.A. Beckman ,John Wiley.
2. Principles of Solar Engineering , F.Kreith and J.F. Kreider McGraw –Hill .
3. Alternative Energy Sources T.N. Veziroglu McGraw –Hill .
4. Biochemical Engineering Fundamentals J.E. Bailey and D.F. Olis, TMH
5. Biochemical Engineering Academic press S.Aiba ,A.E. Humphrey ,N.F. Mills.

MMTP – 302 (C) Pumps, Blowers and Compressors

(TO BE EXPANDED)

Law of momentum .Vortex theory of Euler's head. Hydraulic performance of pumps ,Cavitation.
Jet Pumps : Turboblowers and their characteristics ,cooling tower fan ,Surging .Design of pumps ,blowers, compressors and fans .

Reference Books :

1. Centrifugal and Axial flow pumps A.J. Stepanoff, Wiley.
2. Design and performance of centrifugal and Axial flow pumps and compressors , A.Kovats .