M.TECH MECHANICAL (THERMAL ENGINEERING)

SEMESTER I

VISCOUS FLUID FLOW
Review of basic concepts and fluid properties, Governing equations of fluid flow in differential form, Dynamics of ideal fluid motion, Low Reynolds number approximation of Navier Stokes equation, High Reynolds number approximation, Thermal Boundary layer, Reynolds Analogy, Transition to turbulence, Introduction to Theory of Hydrodynamic Stability, Fundamental of turbulent flows, Turbulent flows in two dimensional channel and pipes.

MODELING OF THERMAL SYSTEMS
Modeling overview, Quantitative Techniques, Systems Simulation, Optimization: Unconstrained & Constrained, Linear Programming, Case studies of optimization in Thermal systems problems, Pinch Analysis, Energy- Economy Models, Numerical solution of Differential equations.

ADVANCED HEAT TRANSFER
Transient heat conduction, Heat conduction with heat generation, Extended surfaces, Thermal boundary layers, Heat transfer with phase change, Radiation heat transfer, Overall heat transfer in furnaces

EXERGY ANALYSIS OF THERMAL SYSTEMS
Basic concepts of energy analysis of thermal systems, Basic exergy concepts, Elements of Plant Analysis, Exergy Analysis in Process, Energy and Exergy Analysis of gas turbine, steam power plant, captive power plant, combined cycle power plant, refrigeration plant, and heat exchanger

ELECTIVE I

REFRIGERATION ENGINEERING
Refrigerants, Analysis of Compound compression systems, Multiple evaporator systems, Absorption refrigeration, Air cycle refrigeration, Steam jet refrigeration and Thermo–electric refrigeration, Preservation and processing of foods by use of refrigeration, design of refrigeration systems for transport refrigeration, walk in coolers and cold storages for different applications

SI ENGINES
Thermo-chemistry of fuel air mixture, Properties of working fluid, Gas exchange processes, SI engine fuel metering and manifold phenomena, Combustion in SI engine, Alternate fuels for SI engine

DESIGN OF THERMAL TURBO-MACHINES
Turbomachines principles of operation, Steam turbines: nozzle design, velocity triangles and its analysis, Two dimensional cascade, Two dimensional theory-axial turbine, Combined cycle power plant

ENERGY CONSERVATION AND AUDIT
Energy Scenario, Energy Efficiency in Thermal Utilities, Energy Efficiency in Electrical Utilities, Energy Performance Assessment for Equipment and Utility systems, Performing Financial Analysis, Applications of Non-Conventional and Renewable Energy Sources, Waste Minimization and Resource Conservation

INSTRUMENTATION FOR ENGINEERS
Significance of Measurement and Instrumentation, Dynamic Response of Instruments, Errors in Measurement and its Analysis, Transducers and Transduction Principles, Data acquisition and Signal Processing, Flow measurement, Temperature and Heat Flux Measurement

SEMINAR
Aim of the seminar is to prepared the students for literature survey for their major M Tech project. The student will prepare a seminar report on relevant topics and will present the same.

SEMESTER II

GAS DYNAMICS
Review of fundamentals, One dimensional isentropic flow, Normal shocks, Flow in constant area duct with friction, Generalized one dimensional flow, Multidimensional flow, Dimensional analysis and similitude, Rarefied gas dynamics, Forces on submerged bodies

DESIGN OF HEAT EXCHANGERS
Classification of heat exchangers, basic design methods for heat exchangers, Computerized methods for design and analysis of heat exchangers, compact heat exchangers, Codes for mechanical design of heat exchangers, performance enhancement of heat exchangers, Fouling of heat exchangers, Testing, evaluation and maintenance of heat exchangers

COMPUTATIONAL FLUID DYNAMICS
Partial differential equations, numerical stability, Tridiagonal matrix algorithm; discretization, Taylor's series approach, polynomial fitting approach, Solution of Steady one and two dimensional conduction, One, two, and three-dimensional transient heat conduction, Finite volume method for diffusion and convection–diffusion problems, Computation of the flow field using stream function–vorticity formulation; SIMPLE, and MAC algorithms

ENERGY ECONOMICS AND MANAGEMENT
Energy Economics, Energy Management, Energy conservation in various equipments, Waste heat recovery, Heat exchanger networking, Demand side management, Financing energy conservation

ELECTIVE II

AIR CONDITIONING ENGINEERING
Applied psychometry, Cooling load calculation, Duct design, Air handling systems, Air conditioning systems, Thermal comfort, Cooling towers, Evaporative cooler, Air conditioning controls

CI ENGINE
Ideal models of engine cycles, Fuel- air cycle analysis, availability analysis of engine processes, Charge motion within the cylinder, Combustion in CI engine, CI Engine simulation

HEAT EXCHANGER NETWORK SYNTHESIS
Introduction, Concept of Pinch, Grand Composite Curves (GCC), Area targeting, Unit targeting, Shell targeting, Cost targeting, Super targeting, Targeting for multiple utilities, Continuous Targeting, Network Evaluation

COMBUSTION
Combustion and Thermo Chemistry, Mass transfer, Chemical Kinetics, Chemical and Thermal Reaction Systems, General Governing Equations for Reacting Flows, Laminar Premixed Flames, Laminar Non-premixed (Diffusion) Flames, Droplet Combustion, Turbulent Premixed Flames, Solid Combustion, Pollutant Emissions and Control

THERMAL INSULATIONS AND DESIGN
Role of insulation in saving of energy, Thermal insulation, important properties of insulation, testing of insulation, Criteria for selection of insulation for different application, Optimization of insulation, Design of insulation for different application, Thermal insulation in buildings: case studies, Different methods for determining thermal conductivity of insulations

SEMESTER III

MAJOR PROJECT PART I
The Major Part I is aimed at training the students to analyze independently any problem in the field of Thermal Engineering. The project may be analytical or computational or experimental or combination of them based on the latest developments in the said area. At the end of the semester, the students will be required to submit detailed report. The Major Project Part I

should consists of objectives of study, scope of work, critical literature review of the Major Project and preliminary work pertaining to the said work.

SEMESTER IV

MAJOR PROJECT PART II

Major Project Part II is a continuation of the work done by the student during semester III. The student is required to submit thesis as a partial fulfillment of the M. Tech degree. The thesis should consist of detailed study of the problem under taken, concluding remarks and scope of future work, if any. The project report (thesis) is expected to show clarity of thought and expression, critical appreciation of the existing literature and analytical, computational and experimental aptitude of the student.