GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Mechanical Engineering (Thermal Engineering)

Subject Name: ADVANCED THERMODYNAMICS & HEAT TRANSFER

Sr. No.	Course Content
1.	Basic concepts of thermodynamics; irreversibility; Review of basic laws of thermodynamics and their consequences; Concept of Exergy and Entropy; Exergy for closed system; Entropy generation; entropy balance for closed system; behavior of gases; Equations of state.
2.	Phase equilibrium; phase rule without chemical reaction; chemical potential of ideal gases; T-ds equations for simple compressible systems; Helmholtz and Gibbs functions; Maxwell relations; generalized relations for changes in enthalpy; entropy and internal energy; equations for specific heats; Clausius clapeyron equation; Joule-Thomson and Joule coefficients; applications of thermodynamic relations.
3.	Review of the basic laws of conduction; One dimensional steady state conduction with variable thermal conductivity and with internal distributed heat source; Extended surfaces-review and design considerations; Two dimensional steady state conduction; Unsteady state conduction; solutions using Groeber's and Heisler's charts for plates, cylinders and spheres suddenly immersed in fluids.
4.	Review of convection and radiation heat transfer laws, Natural and forced convection; Heat transfer in turbulent flow; eddy heat diffusivity; Reynold's analogy between skin friction and heat transfer; von Karman; turbulent flow through circular tubes; Review of radiation principles; diffuse surfaces and the Lambert's Cosine law; Radiation through non-absorbing media; Hottel's method of successive reflections.

Reference Books:

1. Fundamentals of Engineering Thermodynamics, Moran MJ & Shapiro HM, John Wiley,
2. Engineering Thermodynamics work and heat Transfer, Roger Gordon & Yon Mayhew, Addison-Wesley, 2001
3. Thermodynamics an Engineering Approach, Cengel Y.A. & Boles M.A., TMH.
4. Fundamentals of Classical Thermodynamics, Van Wylen GJ & S onntag RE, Wiley

5. Thermodynamics, Wark K. Jr. & Donald E.R.,Mc Graw Hill (6th Edn.); 1999.
6. Fundamentals of Heat Transfer, Encropera
7. Heat, Mass and Momentum transfer, Rohsenow and Choi Prentice Hall
8. Fundamentals of Heat Transfer, Grober, Erk and Mc Graw Hill Grigull
9. Analysis of Heat and Mass Transfer, Eckert and Drake McGraw Hill
10. Thermal Radiation, Siegel and Howell McGraw Hill.
11. Engineering Thermodynamics by Jones & Dugan
12. Engineering Thermodynamics by P. K. Nag
13. Basic Engineering Thermodynamics by T Ray chaudhary
14. Fundamentals of Engineering thermodynamics, R. Yadav.
15. Advanced thermodynamics Engineering, Kalyan Annamalai & Ishwar K Puri, CRC Press.
16. Heat and Mass Transfer, R.K.Rajput
17. Heat and Mass Transfer, D.S.Kumar
18. Handbook of Thermal Engineering, Kreith F

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 1
Mechanical Engineering (Thermal Engineering)

Subject Name: ADVANCED REFRIGERATION

Sr. No.	Course Content
1.	Balancing of vapor compression refrigeration system
2.	Dual pressure vapor compression system and its analysis.
3.	Compound compression with flash cooler and flash intercooler, multiple expansions, parallel operation, sectionalizing, booster operations, various types of cascade systems analysis
4.	Refrigerants: Ecofriendly refrigerants & their properties, secondary Refrigerants, mixture of refrigerants, azeotropics, salient characteristics of various refrigerants. Synthetic lubricating oil &their properties
5.	Absorption refrigeration: H-x charts of LiBr-H2O and NH3-H2O solutions. analysis of vapor absorption refrigeration system on H-X charts, mass concentration &equilibrium charts , heat balance, COP comparison with vapor compression refrigeration systems, two stage vapor absorption refrigeration system ,balancing of vapor absorption refrigeration systems.
6.	Air cycle refrigeration, Analysis of various cycles and their applications. Calculations of COP
7.	Steam jet refrigeration - cycle analysis, analysis on H-O charts performance, control and various applications.
8.	Thermo-electric refrigeration: Thermo-electric effects, analysis of thermoelectric cooling, COP, FOM, thermoelectric, materials.
9.	Heat pumps: Sources and sinks, refrigerant circuits, heating and cooling performance of heat pumps.
10.	Design of refrigeration systems for industrial &other application for transport refrigeration, walk in coolers & cold storages for different applications.
11.	Preservation & processing of food by use of refrigeration.

List of Experiments:

1. Study of advanced refrigeration systems.
2. Performance and analysis of VCR system using capillary tube as a throttling device.
3. Performance and analysis of VCR system using thermostatic expansion valve as a throttling device.
4. Study and design of a steam jet refrigeration system.
5. Study and design of cascade refrigeration system.
6. Performance and analysis of VAR system in "Electrolux" refrigerator.
7. Performance and analysis on Heat Pump system with different working conditions.
8. Design and selection of different components of VCR system.
9. Study of NH3 condensing plant of a cold storage.
10. Study of freeze drying machine.

Reference Books:

1. Threlked, J.L., "Thermal Environmental Engineering", Prentice Hall, N. Y. , 1970.
2. Air conditioning principles and systems –pita
3. ASHRAE Data Book, (1) Fundamentals (2001) (2) application (1999) (3) System and equipments (2000)
4. Refrigeration and air conditioning, stocker
5. Refrigeration and air conditioning, Jordan and priester
6. Refrigeration and air conditioning, C. P. Arora
7. Industrial refrigeration handbook, stoecker,1998

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 1
Mechanical Engineering (Thermal Engineering)

Subject Name: FLUID MECHANICS & GAS DYNAMICS

Sr. No.	Course Content
1.	Review of fundamentals; types of flow; Generalized continuity equation; momentum and energy equations, Euler and Navier-Stokes equations, integration of the momentum equation; the generalized Bernoulli's equation; velocity of sound and its importance; physical difference between incompressible, subsonic and supersonic flows; three reference speeds; dimensionless velocity; concepts of static and stagnation parameters.
2.	Two dimensional flow in rectangular and polar coordinates; stream function; irrotationality and the velocity potential function; vorticity and circulation; plane potential flow and the complex potential function; Sources, sinks, doublets and vortices; flow around corners; Rankine ovals; flow around circular cylinders with the without circulation; pressure distribution on the surface of these bodies; aerofoils theory; Joukowski transformation; circular arc, symmetrical aerofoil theory; Joukowski aerofoils; Joukowski hypothesis; drag, and lift forces.
3.	Flow in constant area duct; friction-governing equations; choking due to friction, performance of long ducts; isothermal flow in long ducts; Flow in constant area duct with heating and cooling; Normal shocks-Introductory remarks; governing equations; Rankine- Hugonout; Prandtl and other relations; weak shocks; thickness of shocks; normal shocks in ducts; performance of convergent-divergent nozzle with shocks; moving shock waves; shocks problems in one dimensional supersonics diffuser; supersonic pilot tube.
4.	Dimensional analysis and similitude: Buckingham _ theorem; Van driest theorem; dimensional analysis; model study; compressible flow of viscous fluids.

List of Experiments:

1. To study calibration characteristics of Rotameter.
2. Study of flow passing through Shocks.
3. Performance and testing of orifice plate, nozzle and Venturimeter.
4. To study different types of Wind tunnel.
5. To study the effect of angle of attack on Lift and Drag force.
6. To study the loss of energy in wake region behind the aerofoil in the wind tunnel.
7. To study the loss of energy in wake region behind various models (car, jeep, bus etc.) in the wind tunnel.
8. To draw profile of NASA Aerofoils.

Reference Books:

1. Advanced Fluid Mechanics, Raudkiri & Callander Edward Ronald
2. Fundamentals of Mechanics, Currie McGraw Hill of Fluids
3. Fluid Mechanics, Landau & Lifshitz Addition Wesley
4. Fluid Mechanics, Som & Biswas Tata McGraw Hyde antic Machinery
5. Gas dynamics, Ali Campbell & lennings.
6. Gas dynamics, Radha Krishnan , PHI
7. Fundamentals of compressible flow, S.M. Yahya, New Age Pub
8. The Phenomena of Fluid, Brodkey Addition Wesley Motion
9. Foundation of Fluid, Yuan Prentice Hall Mechanics

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 1
Mechanical Engineering (Thermal Engineering)

Subject Name: MODELING, SIMULATION & COMPUTER APPLICATION

Sr. No.	Course Content
1.	Concept of system and environment; Continuous and discrete system; linear and nonlinear systems; stochastic activities; static and dynamic models; principles used in modeling; Models classifications, Mathematical models, Physical models, analog models and others, Estimation of model parameters;
2.	Technique of simulation; experimental nature of simulation; numerical computation techniques; continuous system models; analog and hybrid simulation; feedback systems; Stochastic variables; discrete and continuous probability functions; random numbers; rejection method.
3.	Computer technique for simulation; computer generation of Pseudo random; Application, Modeling of Civil, Electrical and Mechanical components of small hydro and Renewable Energy Projects.
4.	Introduction to MATLAB, Various Simulation tools.

Reference Books:

1. System Simulation, Geoffrey Gordon Prentice-Hall
2. System Simulation, The Art and Science, Robert E. Shannon Prentice – Hall
3. System Modeling and Control, J. Schwarzenbach and K. F. Gill, Edward Arnold
4. Modeling and Analysis Of Dynamic Systems, Charles M. Close & Dean K. Frederick Houghton Miffin
5. Simulation of Manufacturing, Allan Carrie John, Wiley & Sons
6. Computational Heat Transfer, Y. Jaluria and K. E. Torrance Hemisphere Publishing
7. System Simulation Dr. D. S. Hira

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 1
Mechanical Engineering (Thermal Engineering)

Subject Name: COMBUSTION ENGINEERING

Sr. No.	Course Content
1.	Combustion thermodynamics; Stoichiometry; first and second laws of thermodynamics applied to combustion; Ignition and combustion in SI engine; Flame travel; turbelent flame propagation; flame stabilization; vaporization; Review of detonation and Diesel knock; effect of various factors; Combustion chambers for SI engines; Combustion in CI engine; Ignition delay and diesel knock; Excess air supply and air motion; Combustion chamber for CI engines-Construction and Performance aspects; M-combustion chamber; latest combustion chamber and technology.
2.	Fundamentals of combustion kinetics' Combustion products in equilibrium; rate of reactions; chain reactions; opposing reactions; consecutive reactions, competitive reactions; Conservation equation for multi component reacting systems.
3.	Combustion of liquid fuel droplet; fuel atomization; types of injectors; spray formation and charactristics; Oil – fired furnace combustion; gas turbine spray combustion; direct injection engine combustion; detonation of liquid gaseous mixture.
4.	Combustion of solid fuels; Coal combustion; combustion of pulverized coal; combustion of coal on bed in a fluidised bed and in a cyclone burners; stabilization of pulverized coal combustion; design consideration of coal burners; combustion generated pollution.

Reference Books:

1. Combustion Engineering – Gary L. Borman, Kenneth W. Ragland, McGraw Hill
2. Principles of Combustion – Kenneth K. Kuo, John Wiley & Sons
3. Fuels & Combustion – S. P. Sharma & Chander Mohan, Tata McGraw Hill
4. Fuels & Combustion - Sarkar
5. Introduction to combustion phenomenon, Kanury murty, Mc-Ggraw hill
6. Combustion, fundamentals, strehlow, Mc-Ggraw hill

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 1
Mechanical Engineering (Thermal Engineering)

Subject Name: CRYOGENIC HEAT EXCHANGERS

Sr. No.	Course Content
1.	Advanced heat transfer: steady state conduction with two and three dimension with heat generation, solution of problem by numerical ,finite difference and graphical methods, matrix ,finite element methods, transient heat conduction and solution by analytical correlation for convective heat transfer for natural and forced convection ,transition flow, flow outside of duets, boiling heat transfer coefficients .pressure drop in two phase flow, frost formulation ,condensation ,heat transfer coefficient during condensation.
2.	Shell & tube type heat exchangers-design
3.	Fin effectiveness , surface effectiveness and overall coefficients of heat transfer. Overall pressure drop, effectiveness- NTU approach solution by equations and graphical methods,. Effect of heat-exchanger effect of various specific on exchanger performance.
4.	Design of regenerative type heat exchanger for single and multi stage, Philips, Gifford single volume, double volume, Vuilleumier, magnetic cryorefrigerators.
5.	Design of heat exchangers for liquefaction systems ,single tube ,double tube Linde heat exchangers three channel heat exchangers ,multiple tube type ,Giaque Hampton and Collins type heat exchangers.
6.	Finned tube and plate type heat exchangers, different configuration heat transfer coefficients and friction coefficient for various configuration..
7.	Single tube Linde exchanger, double tube type, three channel heat exchanger. Linde multiple tube type , Giauque Hampson, Collin's,
8.	Plate fin heat exchanger ,different fin configuration, heat transfer coefficients , and friction factors for various configurations.
9.	Testing of heat exchangers as per standards.

Reference Books:

1. Saunders, E.A.D., ”Heat exchange – selection design and construction”, Longmann Scientific and Technical, N.Y.2001.

2. Kays, V.A and London,A.L., “Compact Heat Exchangers”, McGraw Hill, 2002

3. Holger Martin , “Heat Exchanger” Hemisphere Publ.Corp., Washington,2001

4. Kuppan,T., “Heat Exchangert Design Handbook”, Macel Dekker, Inc., N.Y.,2000

5. Seikan Ishigai, “Steam Power Engineering, Thermal and Hydraulic Design Principles”, Cambridge Univ. Press,2001

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 2
Mechanical Engineering (Thermal Engineering)

Subject Name: DESIGN OF HEAT EXCHANGE EQUIPMENTS

Sr. No.	Course Content
1.	Review of heat transfer principles & convection correlation.
2.	Introduction to heat exchangers and classification.
3.	Basic design methodologies, Net Transferable Units method and Logarithmic Mean Temperature Deference method
4.	Design of double pipe heat exchangers
5.	Shell & tube type heat exchangers, nomenclature, J-factors, conventional design methods, bell, and Delware method.
6.	Compact heat exchangers, J-factors, design method Condensers classification and design methods for surface condensers
7.	Evaporators – Classification and design methods
8.	Plate type – Heat exchangers
9.	Regenerators
10.	Furnace design

List of Experiments:

1. Study of fundamentals of Fluid Flow and Heat Transfer associated with heat exchangers.
2. Design of heat exchange equipment by using method of LMTD.
3. Design of heat exchange equipment by using method of ε – NTU.
4. Design and analysis of Parallel flow and Counter flow heat exchanger.
5. Design and analysis of Shell and tube type heat exchanger.
6. Design and analysis of Plate type heat exchanger.
7. Design of evaporator and condenser for refrigeration system.
8. Design of cooling and air conditioning circuit.
9. Design and analysis of regenerative type heat exchanger for low temperature applications.

10. Case study on design of heat exchanger for process industry.

Reference Books:

1. Saunders, E.A.D., “Heat Exchangers – Selection Design and Construction”, Longmann Scientific and Technical, N.Y., 2001.
2. Kays, V.A. and London, A.L., “Compact Heat Exchangers” , McGraw Hill, 2002.
3. Holger Martin, “Heat Exchangers” Hemisphere Publ. Corp. , Washington, 2001.
4. Kuppan, T., “Heat Exchanger Design Handbook”, Macel Dekker, Inc., N.Y. , 2000
5. Seikan Ishigai, “Steam Power Engineering, Thermal and Hydraulic Design Principles”, Cambridge Univ. Press, 2001.

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 2
Mechanical Engineering (Thermal Engineering)

Subject Name: THERMAL POWER PLANT ENGINEERING

Sr. No.	Course Content
1.	Recent trends in Steam Power Plants, design of combustion chambers, Fluidized bed combustion chambers, burners and selection criteria, combustion calculations, design and selection for economizers, air-preheater, superheater, desuperheaters, and reheaters. Performance testing and maintenance.
2.	Design of Advanced boiler and steam system, heat balance sheet, co-generation and combined cycle, boiler efficiency, thermodynamics and power plant cycle analysis. Power plant layout and selection, Arrangement of units. Advancement in high pressure boilers and miniature boilers.
3.	Classification and comparison of different types of gas turbine power plants, Thermodynamic cycles, Analysis of closed cycle and open cycle gas turbine plants, Methods of improving the thermal efficiency and power output of gas turbine plants.
4.	Different components of gas turbine plants and different arrangements of gas turbine components. Types of combustion chambers used, fuels and fuel handling equipments, Governing of gas turbines. Combined steam and gas turbine plants. Recent developments of gas turbine power plants.
5.	Modern nuclear power plants and their arrangement, types of nuclear furnaces and moderator, heat exchangers, turbines for nuclear power plants. Nuclear waste disposal, Gas disposal system.
6.	Advances in diesel electric power plant, types of engines used, analysis of thermodynamic cycles, supercharging of diesel engine, performance and analysis of diesel power plant, present development in diesel power plant.
7.	Economics Analysis of Power Plant. Cost electric energy, selection of type of generation and generating equipment, performance and operating characteristic, load division and tariff method,

8.	Fluctuating Loads on Power Plants: Introduction, load curves, Different terms and definitions, Effect of variable load on power plant design and operation, Method to meet variable loads.
9.	Peak Load Plants: Requirements, Pump storage power plants, Economical justification of pump storage plant, Their advantages and disadvantages compressed air storage plants, Their advantages and limitation.
10.	Energy conservation and management, distribution of energy consumption, load sharing, need of energy conservation, methods of energy conservation, energy management techniques.

List of Experiments:

1. Case study on selection of size of different elements of steam power plant.
2. Performance and operation methods of in-house (PIET) Power Plant.
3. Experimental performance test on steam power plant: To study boiler operation and calculate boiler capacity, efficiency and all other necessary parameters.
4. Experimental performance test on steam power plant: To study steam turbine operation and calculate steam turbine efficiency, fuel consumption, steam quality, flow rate, condenser effectiveness and all other necessary parameters.
5. Experimental performance test on steam power plant: To calculate dryness fraction of steam, heat balance and energy utilization.
6. Industrial visit of Steam Power Plant, and prepare detail study report.
7. Study of Fluidized bed combustion system and its design.
8. Study of Nuclear Power Plants, properties and reaction of nuclear fuel
9. Study of co-generation and combine cycle.
10. Industrial visit of Nuclear Power Plant, and prepare detail study report.

Reference Books:

1. Black and Vetach, “Power Plant Engineering”, Chapman and Hall, International Thomson Publishing Co., 2001.
2. El, Wakil, ”Power Plant Technology”, McGraw-Hill, 2003.
3. Gebhartt, G. F., ”Steam Power Plant Engineering”, John Wiley & Sons, 2002.
4. Kearton, ”Steam Turbine Theory and Practice”, ELBS, 2001.
5. Burger R., “Cooling Tower Technology”, Chemical Publishing Company
6. Shields, C. D., “Boilers”, McGraw Hill, New York, 2001
7. Babcock-Wilcox manual “Steam”
8. Vandagriff, R.L “Practical guide to boiler systems”, Marcel Dekker, 2000
9. Oliver, K.G “Industrial boiler management, an operations guide, Industrial Press, NewYork. 2002

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 2
Mechanical Engineering (Thermal Engineering)

Subject Name: ADVANCED AIR CONDITIONING

Sr. No.	Course Content
1.	Psychometric charts : ASHRE and CARRIER charts ,their differences ,application of corrections of different charts Applied Psychrometry : Combinations of different processes and their representation on psychrometric charts, psychrometric calculations for cooling and dehumidification .High latent heat load ,dehumidified air quantities based on total and effective room loads ,GSHF and ESHF ,effect of fan and duct heat gain or dehumidified air quantity ,effective surface temperature ,effect of bypass factor on GSHF, analysis for using all outside air ,psychrometric of partial load control
2.	Cooling tower: Different types, construction working performance, testing different types of desert coolers, testing of desert coolers as per BIS, Air washer, different types, construction performance.
3.	Heat gain calculations: choices of supply conditions. Solar heat gain: Terminology calculation different solar angles ,relation between different angles ,calculation of the intensity of direct ,diffused and ground radiation solar air temperature ,empirical methods to evaluate heat transfer through walls, and roofs, TETD and its determination by calculation and tables ,Heat gain through glass ,Solar heat gain factor, use of equations and tables ,shading of glass ,solar chart and its use .shading of glass ,solar chart and its use, shading devices and its selection ,load due to other sources, stack effect ,different methods of calculating cooling load as per ASHRE-some brief idea(other than TETD methods)
4.	Duct Design : Types of ducts ,duct construction ,factors affecting duct construction, friction charts and other correction factors ,losses ,design velocity and its selection, duct heat gain or loss ,duct insulation ,duct layouts, duct sizing methods, equal friction static regains and T-method design simple idea .Noise and their isolation, duct materials and their accessories

5.	Air Distribution: Terminology, outlet performance, types of outlets, location of outlets ,factors affecting grill performance, selection of outlets using nomographs ,tables and line charts ,room air diffusions, performance index (ADPI) and its use in outlet selection ,use of different equations.
6.	Air conditioning systems :Factors affecting the selection of the systems, classification, systems, design procedure, system features, psychrometric analysis, controls of all air, air water, all water, DX ,VAV and dual duct systems basic idea of cold air distributions systems and dessicant cooling systems
7.	Thermal effects :-Human thermo regulation, different equations governing thermal exchanges, factors affecting comforts, environmental indices, AQ and its importance –Human comfort and health.
8.	Air conditioning controls : Characteristics of HVAC noise ,Acoustical rating systems and criteria ,RC ,NC, and NR criteria for noise rating ,noise control methods for VAV units ,cooling towers, air devices roof top units ,chillers ,pumps ,AHU rooms, compressors.
9.	Air handling systems : Fans ,types ,construction performance characteristics ,fan laws ,testing as per BS ,IS and AMCA standards, fan selection with the help of tables charts and curves, fan drive arrangements and discharge from fans, duct design fan selection etc.
10.	Advances in Air Conditioning, Clean Room Concept, Filtration of suspended particles, PPM Control and methods, Types of Filters, Mechanical , UV filters etc.

List of Experiments:

1. Study of advanced air conditioning system.
2. To study various instruments used in air conditioning
3. Study of air conditioning test rig and to plot various processes.
4. Study of clean room and to plot time v/s temperature curve.
5. Study of different types of fans used in air conditioning.
6. Performance and analysis on Air Conditioning system with different psychrometric conditions.

7. Design of air conditioning system and load calculation for residential & commercial buildings.
8. Design of air distribution system and design optimization of ducting.
9. Study of 15 TON water chilling plant.
10. Study and testing of ductable split A / C plant of a conference hall of main building of Parul Institute.

Reference Books:

1. Air Conditioning Engineering -By Jones 5th 2001
2. Thermal Environmental Engineering, Threlkeld
3. Hand book of air conditioning systems design :carrier corporation 1965
4. Air conditioning principles and systems –pita
5. HVAC testing adjusting and balancing manual :Gladstone 3 rd 1997
6. Ashrae Data Book, (1) Fundamentals (2001) (2) application (1999) (3) System and equipments (2000)
7. Hand book of air conditioning and refrigeration : wang 2 (1993
8. Air conditioning application and design by jones 2nd1997
9. Air conditioning system design manual : lorach1993
10. Fan handbook :bleier 1998

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 2
Mechanical Engineering (Thermal Engineering)

Subject Name: COMPUTATIONAL FLUID DYNAMICS

Sr. No.	Course Content
1.	Introduction & Basic concepts: Introduction of CFD, Types of fluids and basic equations of flow, Conservation of mass, Newton's Second law of Motion, Governing equations of fluid flow, Navier-Stokes equations, Boundary layer equations, Expanded form of N-S equations, Conservation of energy principle, Special form of N-S equations, Classification of second order partial differential equations, Initial and boundary conditions, Governing equations in generalized coordinates. Review of essentials of fluid dynamics.
2.	Differential Equations & Discretization: Elementary Finite Difference Equations, Basic aspects of Finite Difference Equations, Errors and Stability Analysis, Discretization , Application to heat conduction and convection, Problems on 1-D and 2-D steady state and unsteady state conduction, Problem on Advection phenomenon, Incorporation of Advection scheme.
3.	Introduction to Finite Element Philosophy: Basics of finite element method, stiffness matrix, isoperimetric elements, formulation of finite elements for flow & hear transfer problems.
4.	Introduction to Finite Volume Philosophy: Integral approach, discretization & higher order schemes, Application to Complex Geometry.
5.	Introduction to solutions of viscous incompressible flows using MAC and simple algorithm.
6.	Solutions of viscous incompressible flows by stream function, vorticity formulation. Two dimensional incompressible viscous flow, estimation of discretization error, applications to curvilinear geometries, derivation of surface pressure & drag.

Experiment list:

1. Exercise on pin-fin analysis
2. Exercise on 1-D steady state heat conduction
3. Exercise on 1-D unsteady state heat conduction
4. Exercise on 2-D steady state heat conduction
5. Exercise on 2-D unsteady state heat conduction
6. Exercise on heat transfer by convection
7. Exercise on fluid flow
8. Exercise on irregular geometry

Reference Books:

1. Anderson D.A., Tannehil j.c.Pletcher R.H." Computational fluid mechanics & heat transfer" Hemisphere publishing corporation,. Newyork, U.S.A2004.
2. Anker S.V., "Numerical heat transfer & flow" Hemisphere corporation, 2001
3. H.K.verstag & W.Malalsekra," An introduction to computational fluid dynamics" Longman-2000
4. Carnahan B, "Applied numerical method" John Wiley & Sons-2001.
5. Patankar, " Numerical heat transfer & Fluid Flow", Mc.GrawHill.,2002
6. Murlidhar K., Sunderrajan T., "Computational Fluid Mechanics and Heat Transfer", Narosa Publishing House.
7. Date A. W., "Introduction to Computational Fluid Dynamics", Cambrige Uni. Press, 2005.
8. Ferziger J. H., Peric M., "Computational Methods for Fluid Dynamics", Springer, 2002.

GUJARAT TECHNOLOGICAL UNIVERSITY
M.E Semester: 2
Mechanical Engineering (Thermal Engineering)

Subject Name: ENERGY CONSERVATION & MANAGEMENT

Sr. No.	Course Content
1.	Energy scenario, Principles of energy Conservation, Energy consumption pattern, Resource availability.
2.	Evaluation of thermal performance, calculation of heat loss – heat gain, estimation of annual heating & cooling load factors that influence thermal performance, analysis of existing buildings.
3.	Organizing for energy conservation programme, the energy audit and energy information system, technology for energy conservation, co-generation of process, steam & electricity, computer controlled energy management,
4.	Strategies for electricity and management, setting up an energy management programme, electricity saving technique by category of end use, Electrical end use in industries, energy & power management in industry, energy management strategies for industry, demand management.
5.	Importance and role of energy management, Energy economics, Payback period, Internal rate of return, life cycle costing.

Reference Books:

1. C.B.Smith, Energy Management Principles, Pergamon Press, New York, 1981.
2. W.C. Turner, Energy Management, Hand Book.
3. Hamies, Energy Auditing and Conservation, Methods, Measurements, Management and Case Study, Hemisphere, Washington, 1980.
4. Kreith, Economics of Solar Energy and Conservation Systems, Vol -3.
5. W.F.Kenny, Energy Conservation in Process Industry.
6. Trivedi, P.R, Jolka K.R., Energy Management, Commonwealth Publication, New Delhi,1997.
7. Witte, Larry C, Industrial Energy Management and Utilization, Hemisphere Publishers, Washinton, 1988.