M.Tech.(TE), R17 Course Structure (Choice Based Credit System)

I SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17TE01	Advanced Thermodynamics	3	-	-	3	3	40	60	100
2	17TE02	Advanced Heat and Mass Transfer	3	-	-	3	3	40	60	100
3	17TE03	Internal Combustion Engines and Pollution	3	-	-	3	3	40	60	100
4	PE-I	Programme Elective –I	3	-	-	3	3	40	60	100
5	PE-II	Programme Elective –II	3	-	-	3	3	40	60	100
6	17TE60	Thermal Systems Lab	-	-	2	2	1	40	60	100
7	17TE61	Simulation Lab	-	-	2	2	1	40	60	100
8	17TE50	Technical Seminar	-	-	2	2	1	100	--	100
10	17TE90	**Add-on-Course-1** Thermal and Nuclear Power Plant Engineering	3	-	-	3	3	40	60	100
		Total	**15/ 18**	**-**	**6**	**21/ 24***	**18/21***	**380/ 420***	**420/ 480***	**800/ 900***

***With inclusion of Add on course**

II SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17TE10	Computational Fluid Dynamics	3	-	-	3	3	40	60	100
2	17TE11	Renewable Energy Technology	3	-	-	3	3	40	60	100
3	17TE12	Design of Thermal Systems	3	-	-	3	3	40	60	100
4	PE-III	Programme Elective –III	3	-	-	3	3	40	60	100
5	PE-IV	Programme Elective –IV	3	-	-	3	3	40	60	100
6	17TE62	Renewable Energy Technology Lab	-	-	2	2	1	40	60	100
7	17TE63	Computational Methods Lab	-	-	2	2	1	40	60	100
8	17TE51	Mini Project	-	-	2	2	1	100	--	100
10	17TE91	**Add-on-Course-2** Fuels, Combustion and Environment	3	-	-	3	3	40	60	100
		Total	**15/ 18***	**-**	**6**	**21/ 24***	**18/ 21***	**380/ 420***	**420/ 480***	**800/ 900***

***With inclusion of Add on course**

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III SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	PE-V	Programme Elective -V	3	-	-	3	3	40	60	100
2	PE-VI	Programme Elective -VI	3	-	-	3	3	40	60	100
3	17TE52	Internship	-	-	-	-	2	100	--	100
4	17TE53	Project Work (Phase-I)	-	-	20	20	10	40	60	100
		Total	**6**	**-**	**20**	**26**	**12/15/18**	**220**	**180**	**400**

IV SEMESTER

S. No	Course Code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17TE54	Project Work (Phase-II)	-	-	32	32	16	40	60	100
2	17TE55	Comprehensive Viva Voce	-	-	4	4	2	100	--	100
		Total	**-**	**-**	**36**	**36**	**18**	**140**	**60**	**200**

List of courses for Programme Elective- I & II

S.No	Course Code	Course Title
1	17TE04	Solar Energy
2	17TE05	Turbo Machines
3	17TE06	Statistical Analysis and Design of Experiments
4	17TE07	Advanced Fluid Mechanics
5	17TE08	Finite Element Methods in Thermal engineering
6	17TE09	Nano Technology

Note: Students are required to choose any two courses as Programme Elective- I & II

List of courses for Programme Elective- III& IV

S.No	Course Code	Course Title
1	17TE13	Optimization Methods in Engineering
2	17TE14	Jet and Rocket Propulsion
3	17TE15	Gas Turbine Theory
4	17TE16	Refrigeration and Cryogenics
5	17TE17	Measurements in Thermal Engineering
6	17TE18	Fuel Cell Technology

Note: Students are required to choose any two courses as Programme Elective- III & IV.

List of courses for Programme Elective- V & VI

S.No	Course Code	Course Title
1	17TE19	Waste Heat Recovery Systems
2	17TE20	Convective Heat and mass transfer
3	17TE21	Heating, Ventilating and Air-conditioning
4	17TE22	Energy Conservation and Management
5	17TE23	Radiative Heat Transfer
6	17TE24	Two Phase Flow and Heat Transfer

Note: Students are required to choose two/one courses as Programme Elective- III & IV , depending on the add-on-courses opted in Semester I & II.

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M.Tech. (I Sem.)	17TE01 - ADVANCED THERMODYNAMICS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Thermodynamics

Course Educational Objective: To provide the insights on the laws of thermodynamics, exergy and irreversibility of thermal systems, non-reactive and reactive mixtures and exergy based power cycles

Course Outcomes: After the completion of the course, students should be able to

- CO1 Understand the laws of thermodynamics applied to mixture of gases and thermodynamic potentials
- CO2 Analyze the thermodynamics laws for various thermal systems
- CO3 Apply the thermodynamics laws to solve various numerical problems
- CO4 Evaluate the thermodynamic properties of various thermal systems
- CO5 Synthesize I law and II law efficiency of various thermal systems.

UNIT - I

BASIC CONCEPTS: Thermodynamics - Temperature and Zeroth law of thermodynamics - First law of thermodynamics-Applications - Limitations of first law - Concept of internal energy - Second law of thermodynamics-Applications - concept of entropy-Third law of Thermodynamics.

THERMODYNAMIC RELATIONS : Introduction – Reciprocity and cyclic relations – The Maxwell's relations – The Gibbs and Helmholtz relations - The Clapeyron Equation – Applications, General relations for du, dh, ds - Co-efficient of volumetric expansion - Isothermal compressibility-Applications.

UNIT- II

KINETIC THEORY OF AN IDEAL GAS: Kinetic theory of gases- introduction, basic assumption, molecular flux, equation of state for an ideal gas, collisions with a moving wall, principle of equipartition of energy, classical theory of specific heat capacity. Transport phenomena-intermolecular forces, The Van der Waals equation of state, collision cross section, mean free path.

UNIT- III

NON REACTIVE GAS MIXTURES: Introduction - Basic definitions for gas mixtures - PVT relationship for mixtures of ideal gases - Properties of mixtures of ideal gases - Entropy change due to mixing - Mixtures of perfect gases at different initial pressure and temperatures - Applications.

REACTIVE GAS MIXTURES: Introduction- Fuels and Combustion-theoretical and actual combustion processes- Enthalpy of formation and Enthalpy of reaction- First and Second law analysis of reacting systems- Applications.

UNIT – IV

EXERGY : Introduction - Availability of heat - Availability of a closed system - Availability function of the closed system - Availability of steady flow system - Availability function of open system- Applications.

IRREVERSIBILITY: Introduction - Irreversibility for closed and open system - Steady flow process – Effectiveness-Applications

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UNIT – V

ADVANCED POWER CYCLES:

Vapor power cycles: - Second law analysis of vapor power cycles, Cogeneration, Binary vapor cycles, combined gas vapor power cycles-Applications.

Gas power cycles: - Second law analysis of gas power cycles-Applications, Atkinson cycle, Lenoir cycle

REFERENCES

1. Sonntag, Borgnakke, Van Wyllan, Fundamentals of Thermodynamics: 5th Edition John Wiley and Sons, 2010.
2. YunusA.Cengel & Michael Boles, Thermodynamics (An Engineering Approach) 7th Edition 2011, TMH
3. E.Rathakrishnan, Fundamentals of Engineering Thermodynamics 2nd Edition, EEE, PHI Publishers, 2010.
4. P.K.Nag, Engineering Thermodynamics: 4th Edition 2008, TMH
5. J.P.Holman, Thermodynamics, 9th Edition, 2012, TMH
6. Kenneth WarkJt.m, Advanced Thermodynamics for Engineers, McGraw – Hill Inc., 1995.

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M.Tech. (I Sem.) **17TE02 - ADVANCED HEAT AND MASS TRANSFER**

L	T	P	Cr.
3	-	-	3

Pre-requisites: Thermodynamics, Heat transfer

Course Objective: To provide students an insight of heat and mass transfer laws, theories to solve the problems of conduction, convection, radiation, two phase flows and mass transfer.

Course Outcomes: At the end of the course the student will be able to

- CO1 Understand the governing equations and boundary conditions of conduction, convection, radiation, boiling, condensation and mass transfer.
- CO2 Apply the concepts of heat transfer and solve problems related to 1-D and 2-D steady and unsteady state heat transfer.
- CO3 Analyze heat transfer phenomenon in various geometries.
- CO4 Formulate the heat transfer equations to solve problems of radiation.
- CO5 Evaluate the mass transfer problems of different gas mixtures.

UNIT - I

INTRODUCTION: Modes of Heat transfer- Governing equations–1-D steady state conduction-Fins of Uniform and Non Uniform cross sections, Rectangular Fin of minimum weight-1-D Heat transfer with internal heat generation.

UNIT-II

TRANSIENT HEAT CONDUCTION: General Lumped capacitance analysis, Transient heat flow in finite and semi infinite solid, Multidimensional systems, use of Heisler chart, Schmidt's method.

2-D STEADY STATE CONDUCTION: Method of separation of variables, FDM.

UNIT - III

FORCED-CONVECTION: General review, Laminar Flow: a similarity solution, Turbulent flow, mixed boundary layer conditions, flow across cylinders and spheres, tube banks – inline and staggered arrangement.

FREE-CONVECTION: Inclined and horizontal plates – the flow pattern and heat transfer,tubes, enclosures, combined free and forced convection.

UNIT - IV

HEAT TRANSFER WITH PHASE CHANGE: Boiling modes, Pool boiling, flow boiling, condensation: Nusselt's theory, Film condensation, drop-wise condensation.

RADIATION: Review of radiation principles - laws of thermal radiation - Surface properties - radiative heat exchange among diffuse, gray and non-gray surfaces separated by nonparticipating media.

GAS RADIATION: Radiation transfer in enclosures containing absorbing and emitting media - interaction of radiation with conduction and convection.

UNIT – V

MASS TRANSFER: Introduction- Analogy between heat and mass transfer-Mass diffusion-Fick's law of diffusion-Boundary conditions-Steady mass diffusion through a wall-Mass convection-Analogy between friction, Heat transfer and Mass transfer coefficients-Significance of Non – dimensional numbers.

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REFERENCES

1. R.C.Sachdeva, Fundamentals of engineering heat and mass transfer, 5th edition, New age publishers,2017
2. Necati Ozisik, Heat Transfer –TMH, 1985
3. Yunus Cengel, Heat Transfer a basic approach –TMH, 2007
4. J.P.Holman,Heat Transfer – TMH, 2010
5. P.S. Ghoshdastidar, Heat Transfer, Oxford Press
6. P.K Nag, Heat & Mass Transfer, TMH
7. Frank Kreith & Mark. Bohn Principle of Heat & Mass Transfer
8. Sadik Kakac and Yaman Yener, Heat Conduction, 2nd Edition, Hemisphere, 2001.
9. Kays, W. M. and Crawford, M. E., Convective Heat and Mass Transfer, 4th Edition, Tata McGraw Hill,2012.
10. Siegel, R. and Howell, J. R., Thermal Radiation Heat Transfer, 4th Edition, Taylor & Francis, 2002.
11. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley & Sons, New York, 2006.

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M.Tech. (I Sem.)	17TE03 - INTERNAL COMBUSTION ENGINES AND POLLUTION	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Thermodynamics, Internal combustion engines

Course objectives: The main objective of the course is to provide the knowledge on reciprocating internal combustion engines with emphasis on automobile and stationary applications with recent developments. The focus is on explaining engine performance in terms of power, energy utilization and exhaust emissions, its relation to internal processes like combustion and gas exchange, and varying engine operating conditions.

Course outcomes: At the end of the course, the student will be able to:

- CO1 Demonstrate the basic principles of internal combustion engine systems.
- CO2 Comprehend the combustion phenomena in SI and CI engines
- CO3 Describe the modern developments in Internal Combustion Engines.
- CO4 Evaluate the performance of I.C engines and comprehend the necessity of alternate fuels
- CO5 Analyze the engine exhaust emissions and its control measures.

UNIT – I

Engine Types and Their Operation:

Introduction and Historical perspective – Engine classifications - Engine components – Two stroke and four stroke engines , comparison of Two stroke and four stroke engines – S.I. Engine operation – C.I. Engine operation, comparison of S.I Engines and C.I Engines ,applications of I.C engines, Engine design and operating parameters ,First law analysis of engine cycle-energy balance.

SUPERCHARGING: Supercharging and scavenging of I.C. engines, supercharging limits.

TURBOCHARGING: Turbo charging – Turbo charging methods

UNIT – II

Combustion in Spark – Ignition Engines:

Introduction – Stages of combustion in SI Engine - Flame front propagation– Factors influencing flame speed - Rate of pressure rise – Analysis of cylinder pressure data – Heat release analysis - Cyclic variations in combustion, partial burning and misfire – Abnormal combustion and knocking – Effects of detonation - Effect of engine variables on detonation – SI Engine combustion chamber design principles – Types of combustion chambers

Combustion in Compression – Ignition Engines:

Introduction – Stages of combustion in CI Engine – Ignition delay – Factors effecting ignition delay – Knocking in CI Engine – Factors affecting knocking - Types of Diesel Combustion systems – Direct injection systems - Indirect injection systems, comparison of combustion Systems - Combustion in direct injection multi spray – Analysis of cylinder pressure data - Heat release analysis.

UNIT – III

Modern Developments in I.C.Engines:

Lean burn engines, ceramic and adiabatic engines, working principle of dual fuel engines, factors affecting the combustion in dual fuel engines, MPFI engines – operation, engines characteristics of multifuel engines. Introduction to working of stratified charged engines,

Wankel engine, working principle of Wankel engine. Features of rotary engines. Variable compression ratio engines, theoretical analysis, methods of obtaining variable compression ratio. Surface ignition engines, free piston engines, EGR, homogeneous charge combustion engines.

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UNIT –IV

Performance of IC Engines and Alternate fuels

Introduction - Parameters of performance – Engine performance characteristics – variables affecting performance characteristics - Pressure- Volume measurement and combustion Analysis performance test – heat balance test problems

Alternate Fuels: Necessity of Alternative fuels – Biodiesels-Transesterification process –Use of Alcohols – Gaseous fuels -CNG – LPG – Hydrogen and Biogas.

UNIT – V

Pollutant Formation and Control:

Nature and extent of problem-Pollution Norms- Types of pollutants-Nitrogen Oxides – Carbon Monoxide – Unburned Hydrocarbons – Particulate Emissions – Measurement of Emissions – Oxides of Nitrogen, carbon monoxide, Unburned Hydrocarbons and smoke – Exhaust gas treatment – Catalytic converters – Thermal reactors – Particulate traps.

REFERENCES

1. John. B.Heywood, "Internal Combustion Engine Fundamentals" Mc Graw -Hill
2. Obert E.F, Harper and Row "Internal Combustion Engine and Air Pollution"
3. V.Ganesan, "Internal Combustion Engines" Tata Mc Graw-Hill.
4. Maleeve V.L,"Internal Combustion Engines" Mc Graw -Hill Book Company
5. Mathur & Sharma, "Internal Combustion Engines" Dhanpatrai Publishers.
6. Colin R.Ferguson, Allan T.Kirkpatrick, "Internal Combustion Engines", John-Wiley &Sons.
7. Obert, E. F., Internal Combustion Engines and Air Pollution, Harper and Row Publishers, New York,1973.
8. Yadav, R., I. C. Engines and Air Pollution, Central Publishing House, 2002.

M.Tech. (I Sem.) **17TE04 - SOLAR ENERGY**

L	T	P	Cr.
3	-	-	3

Pre-requisites: Non conventional sources of energy

Course Objective: To provide students knowledge of solar energy potential, measuring and harnessing devices, systems and its applications.

Course Outcomes: At the end of the course the student will be able to

- CO1 Comprehend the solar energy specialty, potential, measurement and estimation of solar radiation.
- CO2 Analyze the solar energy collection using flat plate collectors and performance.
- CO3 Acquire knowledge on solar concentrating collectors and power cycles.
- CO4 Comprehend the various energy storage systems and other solar devices.
- CO5 Analyze the economics of direct solar energy conversion systems.

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.

UNIT - II

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.-Design of solar water heating system and layout.

UNIT - III

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

UNIT - IV

Thermal energy storage – Introduction – Need - 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.

UNIT - V

Direct energy conversion – solid – state principles – semiconductors – solar cells – performance – modular construction – applications.

Economics: – Principles of Economics Analysis – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost based analysis of water heating and photo voltaic applications.

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REFERENCES:

1. Garg H.P., Prakash J., "Solar Energy Fundamentals and Applications", Tata McGraw-Hill, 2005.
2. Sukhatme S.P.," Solar Energy – Principles of Thermal Collection & Storage", Tata McGraw Hill Publishing Company, 2008.
3. Foster R., Ghassemi M., Cota A., "Solar Energy", CRC Press, 2010.
4. Duffie J.A., Beckman W.A. "Solar Engineering of Thermal Processes", 3rded., Wiley, 2006.
5. De Vos, A., "Thermodynamics of Solar Energy Conversion", Wiley-VCH, 2008.
6. Kalogirou S., "Solar Energy Engineering", Processes and Systems, Elsevier, 2009.
7. Petela, R., "Engineering Thermodynamics of Thermal Radiation for Solar Power", McGraw-Hill Co., 2010.
8. Yogi Goswami D., Frank Kreith, Jan F. Kreider, "Principles of Solar Engineering", Second Edition, Taylor & Francis, 2003.
9. Andrews J., Jelley N., "Energy Science", Oxford University Press, 2010

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M.Tech. (I Sem.) **17TE05 - TURBO MACHINES**

L	T	P	Cr.
3	-	-	3

Pre-requisites: Fluid mechanics and hydraulic machines, Thermodynamics, Steam turbines and gas turbines

Course Objective:
To learn about the Dimensional Analysis for Turbo machines, Performance levels of various pumps, Characteristics of fans, blowers, axial compressors, gas and wind turbines performance.

Course Outcomes: At the end of the course the student will be able to

CO1	Categorize different types of Turbo machines and its importance in Real Industries.
CO2	Solve problems related to real compressors difficulties, steam nozzles and can do job in Pump Industries.
CO3	Analyze and design real world Compressors used in Industries.
CO4	Get familiar with different technologies used in Gas Turbine and Aviation Industries.
CO5	Acquires the ability to solve the Wind Turbine Problems.

UNIT - I
INTRODUCTION: Types of Turbo machines, Applications of Turbo machines, Performance Characteristics, Methods of Analysis
DIMENSIONAL ANALYSIS: Dimensions and Dimensional Homogeneity, Buckingham Pi Theorem, Other Non-dimensional Parameters for Turbo machines, Similarity Laws
ENERGY TRANSFER IN TURBO MACHINES: Review on Fluid Mechanics Related to Turbo machinery, Energy in Flowing Fluids, Euler Equations, Equations for Axial Flow Machines, Equations for Mixed and Radial Flow Machines. Degree of Reaction

UNIT - II
CENTRIFUGAL PUMPS: Basic Construction and Classification, Basic Working Principles, Performance Characteristics, Cavitation, Performance Modifications, Preliminary Design Procedure, Pump Performance Tests Axial.
STEAM NOZZLES: Convergent and Convergent – Divergent nozzles,Energy balance,effect of backpressure on the analysis

UNIT - III
CENTRIFUGAL FANS BLOWERS AND COMPRESSORS: Classification Performance Parameters and Characteristics, Change of Performance, Polytropic Efficiency, Preliminary Design of Centrifugal Compressors
AXIAL FLOW COMPRESSORS: Introduction. Basic Theory, Preliminary Design of Compressor Stage, Determination of Stage Efficiency, Axial Flow Compressor Performance, Surge and Stall in Compressor and the Remedies

UNIT – IV
GAS TURBINES: Introduction, Thermodynamics of Axial Flow Turbine, Degree of Reaction, Preliminary Design Procedure for Turbine Stage, Determination of Turbine Stage Efficiency, Axial Flow Turbine Performance, Compressor, Turbine Matching, Radial Inflow Gas Turbine, Thermodynamic Processes in Radial Inflow Gas Turbine.

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UNIT - V

WIND TURBINES: Introduction to Wind Power, Actuator Theory, Types of Wind Turbines, Wind Turbines Characteristics and Preliminary Design Analysis, Variable Speed Performance of Wind Turbines, Wind Turbine Applications.

REFERENCES :

1. William W Perg, Fundamentals of Turbo machinery: John Wiley & Sons, Inc.
2. D. G. Shepherd, Principles of Turbo Machinery, The Macmillan Company
3. Cohen, H., Rogers, G.E.C., and Saravanamuttoo, Gas Turbine Theory, H.I.H Longman Group Ltd, John Wiely, 5th Edition 2001.
4. Philip Hill and Carl Peterson Mechanics and thermodynamics of Propulsion-, Prentice Hall
5. Dixon,Fluid Mechanics, Thermodynamics of Turbo machinery, Pergamon Press
6. Ganesan, V, Gas Turbines, Tata McGraw-Hill, New Delhi.
7. Mattingly J D, Elements of Gas turbine Propulsion, McGraw Hill, 1st Edition.1997.

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M.Tech. (I Sem.)	17TE06 - STATISTICAL ANALYSIS AND DESIGN OF EXPERIMENTS	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Fluid mechanics and hydraulic machines, Thermodynamics, Steam turbines and gas turbines

Course Educational Objectives:
This course provides the concepts of analyzing the experimental data and design of experiments. It covers the basics of probability, sampling and analyzing the experimental data, concepts of single and several factors experimental design criteria. Further, the regression analysis and optimization of the parameters are addressed in this course.

Course Outcomes: After the completion of this course, the student will be able to:

CO1	Identify the need for the strategies of design of experiments and probability.
CO2	Acquire the knowledge of random variables used in the experimental strategies
CO3	Analyze the vast experimental data using the sampling criteria.
CO4	Design the experiments with single factor and several factors.
CO5	Apply the regression analysis and response surface methods to optimize the parametric data.

UNIT-I
INTRODUCTION: Strategy of experimentation, some typical applications of experimental design, Basic principles, Guidelines for designing experiments, a brief history of statistical design, using statistical design in experimentation.
BASICS OF PROBABILITY: Random experiments, sample space and events, interpretation of probability, axioms of probability, conditional probability, probability rules, Baye's theorem.

UNIT-II
RANDOM VARIABLES: Definition, attributes of a random variable, types of random variables, examples
DISCRETE RANDOM VARIABLES: Introduction, probability distributions and probability mass functions, cumulative distribution function, mean and variance of a discrete random variable, Binomial and Poisson distribution.
CONTINUOUS RANDOM VARIABLES: Introduction, probability distributions and probability density functions, cumulative distribution function, mean and variance of a continuous random variable, normal distribution.

UNIT-III
SIMPLE COMPARATIVE EXPERIMENTS: Introduction, Basic statistical concepts, Sampling and Sampling Distribution, Inferences about the Differences in means, randomized designs, paired comparison Designs, Inferences about the Variances of Normal Distributions.

UNIT-IV
DESIGN AND ANALYSIS OF EXPERIMENTS WITH SINGLE FACTOR: Basic principles and guidelines of design of experiments, single factor experiments, Analysis of Variance (ANOVA), block design
DESIGN AND ANALYSIS OF EXPERIMENTS WITH MULTIPLE FACTORS: Introduction to Factorial design, the two factor factorial design, general factorial design, 2^k factorial designs, confounding and blocking in factorial designs

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UNIT-V

REGRESSION ANALYSIS: Introduction, simple linear regression analysis, multiple linear regression model, model adequacy checking.

RESPONSE SURFACE METHODOLOGY: Response surface methodology, parameter, optimization, robust parameter design and its application to control of processes with high variability.

REFERENCES:

1. Montgomery D.C., Runger G. C., Applied Statics and Probability for Engineers, John Wiley
2. Montgomery D.C., Design and Analysis of Experiments, John Wiley.
3. Robert L. Mason, Richard F. Gunst, James L. Hess, Statistical Design and Analysis of Experiments: With Applications to Engineering and Science, John Wiley.
4. Montgomery D.C., Peck E.A., Vining G.G., Introduction to Linear Regression Analysis, John Wiley.
5. Myres R.H., Montgomery D.C., Anderson-Cook C.M., Response Surface Methodology: Process and Product Optimization Using Designed Experiments, John Wiley.

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M.Tech. (I Sem.) **17TE07 - ADVANCED FLUID MECHANICS**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Fluid mechanics

Course Objective: To make the students exposed to the study of compressible and incompressible flows of fluids viscous and non-viscous, boundary layer concepts, turbulent flow and gas dynamics.

Course Outcomes: At the end of the course the student will be able to

- CO1 Acquires knowledge upon the different types of flows and applications to industrial flow systems
- CO2 Get an exposure upon basic principles of governing equations' in fluid flows and exposure upon the growth of boundary layer
- CO3 Able to calculate velocity fields potentials and forces in fluid flows
- CO4 Develop the idea about the compressible fluid flows and gives ability to solve the problems related to compressible flows
- CO5 Get an ability to design the flow systems

UNIT-I

BASIC CONCEPTS: Continuum hypothesis – Eulerian and Lagrangian descriptions. Derivation of general differential equations – continuity momentum and energy of incompressible flow- Navier Stokes equation for Viscous Fluids (Rectangular Coordinate Systems)- Euler"s equations for ideal fluids- Bernoulli"s equations (one dimensional) – applications.

LAMINAR FLOW VISCOUS INCOMPRESSIBLE FLUIDS: Flow similarity – Reynolds number, flow between parallel flat plates, Couette-flow, plane Poiseuille flow, Hagen – Poiseuille flow.

UNIT-II

LAMINAR BOUNDARY LAYER: Boundary layer concept, Prandtl"s approximations, Blassius solution for a flat plate without pressure gradient – momentum integral equation – Von-Kerman integral relation – Pohlhausen method of obtaining approximate solutions. Displacements thickness, momentum thickness and energy thickness. Boundary layer separation and control. Kerman integral equation.

UNIT-III

INTRODUCTION TO TURBULENCE: Origin of turbulence, nature of turbulent flow – Reynolds equations and Reynolds stresses, velocity profile.

COMPRESSIBLE FLUID FLOW BASICS: Mach number, Flow pattern in compressible flow, classification of compressible flow, isentropic flow, stagnation properties.

UNIT-IV

GAS DYNAMICS: Compressible flow through duct and nozzles – area velocity relations. Flow through convergent and convergent divergent nozzles. Real nozzles flow at design conditions. Introduction to normal compression shock – normal shock relations. Introduction to Fanno Raleigh equations.

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UNIT-V

FLOW IN DUCTS WITH FRICTION: Fanno line, adiabatic constant area- Flow of perfect gas, chocking due to friction in constant area flow- Introduction to constant area flow with heat transfer (Raleigh line)

REFERENCES

1. "Foundations of Fluid Mechanics", Yuan S.W. Prentice Hall – Eastern economy edition, 1983.
2. "Gas Dynamics", Zucrwo M.J. and Hoffman J.D.Vol-I & Vol-II, John Wiley and Sons Inc. 1977.
3. "Fundamentals of Compressible Flow", - Yahya S.M. Wiley Eastern.
4. "A Brief Introduction to Fluid Mechanics" Young, Munsen and Okiisyi, 2nd Edition, John Wiley, 2000.
5. " Fluid Mechanics, Frank.M.White 5th Edn – McGraw Hill, 2005.
6. D. Rama Durgaiah. (Fluid Mechanics and Machinery –New Age Publishers
7. William F. Hughes & John A. Brighton -Fluid Dynamics Tata McGraw-Hill
8. Schlichting H – Boundary Layer Theory (Springer Publications).
9. Pai - An Introduction to Compressible Flow.
10. Shapiro - Dynamics & Theory and Dynamics of Compressible Fluid Flow.

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M.Tech. (I Sem.)	17TE08 - FINITE ELEMENT METHODS IN THERMAL ENGINEERING	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Mathematics, Fluid mechanics and heat transfer

Course Objective: To make the students exposed to the study of finite element methods to solve the structural and thermal problems of various geometries.

Course Outcomes: At the end of the course the student will be able to

- CO1 Acquires knowledge upon the different types of formulation techniques and static analysis of bars.
- CO2 Get an exposure upon basic principles of governing equations' in fluid flows and exposure upon the growth of boundary layer
- CO3 Able to calculate velocity fields potentials and forces in fluid flows
- CO4 Develop the idea about the compressible fluid flows and gives ability to solve the problems related to compressible flows.
- CO5 Get an ability to design the fluid flow systems

UNIT - I

FORMULATION TECHNIQUES: Potential energy method, Raleigh Ritz method, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions, introduction to FEM.

1-D STATIC ANALYSIS OF BARS: Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Stiffness matrix for a Quadratic Element.

UNIT - II

1-D STEADY-STATE HEAT TRANSFER: FE Formulation using linear and quadratic elements, Numerical problems in composite walls and fins of uniform cross section using linear elements.

1-D TRANSIENT HEAT TRANSFER: Derivation of element matrices, solution techniques, A numerical problem with 2 elements.

UNIT - III

2-D STEADY-STATE HEAT TRANSFER: FE Formulation using linear triangle elements, Problem modeling and boundary conditions.

Isoparametric formulation, Numerical integration (1-D, 2-D).

UNIT - IV

INTERPOLATION FUNCTIONS: Compatibility and completeness requirements, Selection of polynomials and derivation of interpolation functions for 1-D and 2-D elements

UNIT - V

APPLICATIONS IN FLUID MECHANICS: Finite Element formulation of 1-D and 2-D Steady, incompressible, inviscid, irrotational fluid flows, Problem modeling and boundary conditions.

REFERENCES

1. David V.Hutton – Fundamentals of Finite Element Analysis, Tata Mc Graw Hill
2. S.S. Rao – The finite element method in Engineering- BH Publication
3. Chandraputla & Belagondu –Introduction to Finite elements in Engineering
4. J.N. Reddy - Finite element method in Heat transfer and fluid dynamics, CRC press

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M.Tech. (I Sem.) **17TE09 - NANO TECHNOLOGY**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Engineering Physics, Engineering Chemistry

Course Objective: To make the students exposed to the study of nano materials, nano material preparation and characterization and its applications.

Course Outcomes: At the end of the course the student will be able to

- CO1 Acquire knowledge upon the basics of nano materials.
- CO2 Get an exposure upon various types of synthesis adopted to prepare a nano material.
- CO3 Know the fabrication of nano material using different techniques.
- CO4 Develop the idea about the various ways of nano material availability and applications.
- CO5 Get an exposure to the thermal characterization of nano materials for thermal systems.

UNIT – I

Introduction to nanomaterials, Properties of materials & nanomaterials, role of size in nanomaterials, nanoparticles, semiconducting nanoparticles, nanowires, nanoclusters, quantum wells, conductivity and enhanced catalytic activity compared to the same materials in the macroscopic state.

UNIT – II

Chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and co-precipitation; Metal nanocrystals by reduction, Sol-gel synthesis; Microemulsions or reverse micelles, myle formation; Solvothermal synthesis; Thermolysis routes, Microwave heating synthesis; Sonochemical synthesis; Electrochemical synthesis, Photochemical synthesis, Synthesis in supercritical fluids.

UNIT – III

Fabrication of Nano materials by Physical Methods: -Inert gas condensation, Arc discharge, Plasma arc technique, RF plasma, MW plasma, Ion sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition method and Electro deposition.

NANOCOMPOSITES: An Introduction: Types of Nano composite (i.e. metal oxide, ceramic, glass and polymer based); Core-Shell structured nano composites Super hard Nano composite: Synthesis, applications and milestones.

UNIT – IV

Nano ceramics: Dielectrics, ferroelectrics and magneto ceramics, Magnetism; Dia-, Para-, Ferro-, Anti ferro-, Ferri-magnetism, Magnetic properties; Gaint magneto resistance, Tunneling magneto resistance, Colossal magneto resistance, Super paramagnetism High Tc materials: YBCO and Bi-systems (Brief idea), Superconducting nano-materials & their properties and applications. Carbon Nano Structures: DLCs, Fullerenes, C60, C80 SWNT and MWNT; Properties: Mechanical, Optical and Electrical properties.

UNIT – V

Thermo Electric Materials (TEM): Concept of phonon, Thermal conductivity, Specific heat, Exothermic & Endothermic processes. Bulk TEM Properties, Different types of TEM; One dimensional TEM; Composite TEM; Applications.

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REFERENCES

1. Nanochemistry:A chemical approach to nanomaterials by G.A.Ozin,A.C.Aresnault, L.Cadematriri,RSC Publishing
2. Microfabrication and Nanomanufacturing- Mark James Jackson
3. Chemistry Of nanomaterials : Synthesis, Properties and applications by CNR Rao et.al.
4. Nanoparticles: From Theory to applications– G.Schmidt, Wiley Weinheim 2004.
5. Fabrication Of fine pitch gratings by holography, electron beam lithography and nano - Imprint lithography (Proceedings Paper) Author(s): Darren Goodchild; Alexei Bogdanov; Simon Wingar; Bill Benyon; Nak Kim; Frank Shepherd
6. A Three Beam Approach To TEM Preparation Using In- Situ Low Voltage Argon Ion Final Milling In a FIBSEM
7. Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005),11:830 - 831 Cambridge University Press.
8. Processing & Properties of structural nano materials - Leon L. Shaw (editor)
9. Nanochemistry: A Chemical approach to Nanomaterials Royal Society of Chemistry, CambridgeUK2005.1.Nanocomposite science and technology P.M.Ajayan, L.S.Schadler, P.V.Braun,Wiley,NewYork.

M.Tech. (I Sem.) **17TE60 - THERMAL SYSTEMS LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites : Thermodynamics, Heat transfer, Internal combustion engines.

Course Educational Objectives: The main objective of this laboratory is to familiarize the basic principles and its recent advancements in the area of Internal Combustion engines for Graduates and Post graduates. To study and analyze the various performance parameters such as fuel consumption, frictional power, mechanical efficiency etc. The graduates are empowered with principles of working and its performance analysis on Refrigerator, Air Conditioner, Air compressor, solar concentrator and fuel testing apparatus. It also focuses on to measure the amount of exhaust emissions coming from the engines and creating awareness among the graduates about its impact on the global environment.

Course Outcomes: At the end of the course the student will be able to

- CO1 Acquire the knowledge on fuel characterization.
- CO2 Analyze the performance characteristics of an internal combustion engines
- CO3 Evaluate the performance parameters of refrigeration systems
- CO4 Analyze the air compressor characteristics
- CO5 Evaluate the performance parameters of parabolic solar collector

List of Experiments

At least 10 Experiments are required to be conducted.

1. Performance test and analysis of exhaust gases on single cylinder 4-Stroke diesel Engine by using rope brake dynamometer.
2. Performance Test on Variable Compression Ratio on single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer
3. Performance test on VCR System.
4. Performance test on Multi stage Air Compressor unit.
5. Performance test on Air conditioning unit.
6. Performance analysis of heat pipe.
7. Determination of thermal conductivity of composite material.
8. Critical Heat Flux Apparatus
9. Shell and Tube Heat Exchanger.
10. Counter Flow Heat Exchanger.
11. Combustion analysis of computer aided CI engine test rig.
12 Performance test on solar parabolic collector.
13. Determination of thermal conductivity of given liquid

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M.Tech. (I Sem.) **17TE61 - SIMULATION LAB**

L	T	P	Cr.
-	-	2	1

Pre requisites: Theory courses in Heat Transfer and Numerical Methods

Course Educational Objectives: To make the student understand

1. solution of problems of heat conduction using fem software
2. solving problems involving heat transfer from fins by writing program codes in MAT lab software
3. solving problems containing flow and heat transfer using FVM software

Course Outcomes: At the end of the course the student will be able to

CO1 write program source codes to some heat transfer problems and solve them using MAT lab

CO2 Compute heat transfer problems using FEM software

CO3 Simulate problems involving flow and heat transfer using ANSYS

LIST OF NUMERICAL PROBLEMS:

The following problems are solved using MATLAB, FEM and FVM softwares.
Any TEN numerical problems.

1.Study of simulation software Like ARENA , MATLAB. FEM and FVM softwares.
2. Simulation of translational and rotational mechanical systems
3.Simulation of Queuing systems
4. Two dimensional steady state heat conduction in a slab.
5. One dimensional unsteady state heat conduction in a slab.
6. Heat transfer from a rectangular fin.
7. Heat transfer from a triangular fin.
8. Laminar flow through a rectangular duct.
9. Laminar natural convection from a vertical plate.
10. Parallel flow double pipe heat exchanger.
11. Counter flow heat exchanger.
12. Solution of a Tridiagonal matrix (TDM) using Thomas algorithm.
13. Solution of a second order ordinary differential equation by fourth-order Runge Kutta Method.
14. Solution of simultaneous first order ordinary differential equations by fourth-order Runge-Kutta Method.

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M.Tech. (I Sem.)	17TE50 - TECHNICAL SEMINAR	L	T	P	Cr.
		-	-	2	1

Course Objective: To make the students acquire the skills of presenting the technical presentations, improve oral communication and expertise in preparing the technical content for effective presentation.

Course Outcomes: At the end of the course the student will be able to

CO1	Identify and compare technical and practical issues related to the area of course specialization.
CO2	Understand the latest developments in thermal engineering through literature survey
CO3	Prepare a well organized report employing elements of technical writing
CO4	Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

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M.Tech. (I Sem.)	17TE90 - THERMAL AND NUCLEAR POWER PLANT ENGINEERING	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Thermodynamics, Thermal engineering, Power plant engineering.

Course Educational Objectives: To study the various power plant potentials, waste heat recovery systems and their working principles.

Course Outcomes: At the end of the course the student will be able to

- CO1 Understand the importance of various energy sources and combustion of fuels.
- CO2 Comprehend the steam power plants and steam generators.
- CO3 Analyze the gas turbine power plants and various waste heat recovery systems.
- CO4 Acquire knowledge on nuclear energy based power plants.
- CO5 Interpret the power plants economics, power plant instrumentation and pollution issues.

UNIT - I

INTRODUCTION-Sources of Energy, Types of power plants, Direct energy conversion system, Recent developments in power generation, Combustion of coal, Volumetric analysis, Gravimetric analysis, Flue gas analysis.

FUELS AND COMBUSTION : Coal, Fuel oil, Natural and Petroleum gas, Emulsion firing, Coal – oil and coal – Water mixtures, Synthetic fuels, Bio-mass, Combustion reactions, Heat of combustion and Enthalpy of combustion, Theoretical flame temperature, Free energy of formation, Equilibrium constant, Effect of dissociation.

UNIT - II

STEAM POWER PLANTS: Introduction-General layout of Steam Power Plant, Modern Coal fired Steam Power Plants, Power Plant Cycles, Fuel Handling, Combustion Equipment, Ash handling, Dust Collectors- ESP, fabric filters, bag houses.

STEAM GENERATORS: Basic types of steam generators, Economisers, Superheaters, Reheaters, Steam generator control, air preheater, fluidized bed boilers, feed water treatment, deaeration, evaporation, internal treatment, boiler blow down, steam purity

UNIT - III

GAS TURBINE POWER PLANT: Types-Working-Cogeneration, Combined Cycle with Gas Production from coal (IGCC Power Plants), combined cycles using PFBC-system, Combined cycle with organic fluids, advantages of combined cycles, Performance of Combined cycle, Future of Combined Cycle

WASTE HEAT RECOVERY SYSTEMS:- Introduction, Sources of Waste Heat and Their Grading, Thermodynamic Cycles for Waste Heat Recovery, Recovery forms and Methods, Other uses of Waste Heat

UNIT - IV

PRINCIPLES OF NUCLEAR ENERGY: Introduction-Atomic structure – Chemical and Nuclear equations – Energy from Nuclear reactions – Nuclear Fission and Fusion – Energy from fission and fuel burn up – Radioactivity – Decay rates and Half lifes –Fission reactor types

NUCLEAR POWER PLANTS: Nuclear Reactors-Classification-Types of Reactors, Site selection, Methods of Enriching Uranium- Applications of Nuclear Power Plants.

Nuclear Power Plant Safety: Bi-Products of Nuclear Power Generation-Nuclear Waste Disposal-Future of Nuclear power.

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UNIT - V

ECONOMICS OF POWER GENERATION: Factors affecting the economics , Load factor, Utilization factor, Performance and operating characteristics of Power plants-Economic load sharing, Depreciation-Energy rates-Criteria for optimum loading-Specific economic energy problems.

POWER PLANT INSTRUMENTATION: Classification-Pressure measuring Instruments-Temperature measurement and Flow measurement-Analysis of combustion gases-Pollution-Types-Methods to control.

REFERENCES

1. M.M. EI. Wakil Power Plant Engineering — McGraw Hill,1985.
2. P.K. Nag Power Plant Engineering --TMH
3. John R.Lamarsh, Anthony J.Baratta, Introduction to Nuclear Engineering- Printice Hall
4. Arora, S. C. and Domkundwar, S., Power Plant Engineering, Dhanpat Rai & Sons, 2012.
5. Glasstone, S. and Sesonske, A., Nuclear Reactor Engineering: Reactor Design Basics, Vol. I & II, CBS Publishers & Distributors Pvt. Ltd, 2004.
6. Sharma, P.C., Power Plant Engineering, S. K. Kataria & Sons, 2010.

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M.Tech. (II Sem.) **17TE10 - COMPUTATIONAL FLUID DYNAMICS**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Mathematics, Fluid mechanics, Heat transfer.

Course Objective: To give an insight of fluid flow behavior of compressible and incompressible in nature and heat transfer through mathematical equations and computational fluid dynamics.

Course Outcomes: At the end of the course the learner will be able to

- CO1 Derive the basic governing equations applied for fluid flow problems.
- CO2 Apply the differential equations to fluid flow problems.
- CO3 Understand the concept of discretization.
- CO4 Solve simple algorithms for incompressible fluid flow.
- CO5 Apply the basics of CFD to heat transfer problems.

UNIT - I

INTRODUCTION: Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics

GOVERNING EQUATIONS OF FLUID DYNAMICS: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation

UNIT - II

MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS: Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations

UNIT - III

BASICS ASPECTS OF DISCRETIZATION: Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT - IV

INCOMPRESSIBLE FLUID FLOW: Introduction, Implicit Crank-Nicholson Technique, Pressure Correction Method, Computation of Boundary Layer Flow

UNIT - V

HEAT TRANSFER: Finite Difference Applications in Heat conduction and Convention – Heat conduction, steady heat conduction, in a rectangular geometry, transient heat conduction, Finite difference application in convective heat transfer.

REFERENCES

1. John. D. Anderson Computational fluid dynamics - Basics with applications - / Mc Graw Hill.
2. Anderson, D.A.,Tannehill, I.I., and Pletcher, R.H.,Taylor and Francis Computational Fluid Mechanics and Heat Transfer,
3. Suhas V. Patankar-Numerical heat transfer and fluid flow / Butter-worth Publishers
4. T. K Sengupta, Fundamentals of Computational Fluid Dynamics, University Press
5. Hoffmann, K. A. and Chiang, S. T., Computational Fluid Dynamics for Engineers, Vol. I, II, and III, 2nd Edition, Engineering Education System, 2000.
6. Chung, T. J., Computational Fluid Dynamics, 2nd Edition, Cambridge University Press, 2010.
7. Anderson, J. D. (Jr.), Computational Fluid Dynamics, McGraw Hill, 2010.
8. Tannehill, J. C., Anderson, D. A. and Pletcher, R. H., Computational Fluid Mechanics and Heat Transfer,2nd Edition, Taylor & Francis, 2002.

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M.Tech. (II Sem.)	17TE11 - RENEWABLE ENERGY TECHNOLOGY	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Non conventional energy sources

Course Educational Objectives

To provide the potential importance of renewable sources of energy, energy scenario in and around the world and various renewable energy technological developments.

Course Outcomes : After the completion of the course, students should be able to

- CO1 Classify the latest developments and methods emerging in the field of renewable energy technology.
- CO2 Analyze the importance of renewable energy conversion systems.
- CO3 Apply the knowledge of solar energy availability to various energy systems
- CO4 Evaluate the power outputs of various renewable energy conversion systems
- CO5 Synthesize renewable energy system applications.

UNIT - I

RENEWABLE ENERGY TECHNOLOGIES

- World energy use – Reserves of energy resources – Environmental aspects of energy utilization – Renewable energy scenario in India – Potentials – Achievements – Applications- General Principles –Heat Energy Conversion Processes –Engine Conversion of Solar Energy-Mechanical Energy Conversion Processes-Magneto Hydrodynamic Converters-Solar Radiation Conversion – Solar Thermal Conversion.

UNIT - II

ENERGY TRANSMISSION & STORAGE

Energy Transmission –Heat Storage –High Quality Energy Storage-Solar Energy- Solar thermal – Flat plate and concentrating collectors – Solar heating and cooling techniques – Solar desalination

UNIT - III

SOLAR APPLICATIONS: Solar Pond – Solar cooker – solar thermal power plant – Solar photo voltaic conversion – Solar cells- PV applications.

WIND ENERGY: Wind Energy- Wind data and energy estimation – Types of wind energy system – Performance – Details of wind turbine generator – safety and environmental aspects.

UNIT - IV

BIOMASS ENERGY- Biomass direct combustion – Biomass gassifier – Biogas plant – Ethanol production – Bio diesel – Cogeneration – Biomass applications.

UNIT - V

OTHER RENEWABLE ENERGY SOURCES- Tidal energy – Wave energy- Open and closed OTEC Cycles – Small hydro – Geothermal energy – Fuel cell systems.

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REFERENCES

1. G.D.Rai, Non Conventional Energy Sources, 5th Edition Khanna Publishers, New Delhi, 2011.
2. Bent Sorensen, Renewable Energy ,Physics ,Engineering ,Environmental Impact ,Economics & Planning ,4th Edition ,Elsevier 2011
3. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K.1966.
4. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986.
5. D.P.Kothari ,K.C.Singal ,RakeshRanjan ,Renewable Energy Sources and Emerging Technologies ,Eastern Economy Edition ,2nd Edition 2012
6. Sukhatme, S.P. and Nayak, J.K., Solar Energy - Principles of Thermal Collection and Storage, Tata McGraw Hill, New Delhi, 2008.
6. Khan, B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.
7. Duffie, J.A. and Beckman, W.A., Solar Energy-Thermal Processes, John Wiley, 2001.

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M.Tech. (II Sem.) **17TE12 - DESIGN OF THERMAL SYSTEMS**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Fluid mechanics, Heat transfer, Refrigeration and Air conditioning.

Course Educational Objectives : To know the design procedure of heat exchangers related to different thermal applications like condensers, evaporators, cooling towers etc. and cooling of electronic components.

Course Outcomes: After the completion of the course, students should be able to

- CO1 Classify the different heat exchanger and methods of LMTD and NTU approaches.
- CO2 Analyze the design procedures applicable to various thermal systems
- CO3 Apply the design procedure to solve various heat exchanger problems.
- CO4 Evaluate the design parameters related to thermal systems.
- CO5 Identify various techniques for cooling of electronic equipments.

UNIT – I

CLASSIFICATION OF HEAT EXCHANGERS: INTRODUCTION- Recuperation & Regeneration-Tubular heat exchangers-Double pipe, Shell and Tube heat exchangers, Plate heat exchanger Exchangers-Plate fin and Tubular fin heat exchangers

BASIC DESIGN METHODS OF HEAT EXCHANGERS: Basic equations in Design, Overall heat transfer coefficient-LMTD method for heat exchanger analysis-Parallel flow, Counter flow, Multi pass,

CROSS FLOW HEAT EXCHANGER DESIGN CALCULATIONS – Effectiveness method (NTU))-Keys and London charts-Compact Heat exchangers – Heat Transfer optimization

UNIT - II

DESIGN OF CONDENSERS: Types of Condensers-Air cooled condenser –Water cooled condensers-Evaporative condensers-Heat Transfer in condensers-Desuperheating-Condensing heat transfer coefficient-Condensation outside horizontal tubes-Condensation inside horizontal tubes-Water side coefficient-Fouling factor-Air side coefficient-Augmentation of condensing heat transfer coefficient-Influence of air inside condensers

UNIT - III

DESIGN OF EVAPORATORS: Types of Evaporators-Heat transfer in Evaporators-Pool boiling – Heat transfer coefficient for Nucleate pool boiling-Flow or forced convection boiling-Forced convection boiling correlations-Horizontal Vs. Vertical tube-Effect of oil in refrigerant on heat transfer-Extended surface evaporators-Cooling and dehumidifying coils-Augmentation of boiling heat transfer-Pressure drop in evaporators

UNIT – IV

DESIGN OF COOLING TOWERS AND SPRAY PONDS: Classification-performance of cooling towers – analysis of counter flow cooling towers- enthalpy-temperature diagram of air and water-cooling ponds- types of cooling ponds –cross flow cooling towers- procedure for calculation of outlet conditions.

UNIT – V

COOLING OF ELECTRONIC EQUIPMENT: Introduction-The chip carrier-Printed circuit boards-Cooling load of Electronic equipment

CONDUCTION COOLING: Conduction in chip carriers-conduction in printed circuit boards-heat frames.

AIR COOLING: Natural convection and radiation- Forced convection- Fan selection-cooling personal computers and Heat Pipes.

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REFERENCES

1. NecatiOzisik, Heat Transfer –TMG, 1985
2. C.P.Arora, Refrigeration & Air-Conditioning TMH, 2001
3. J.D. Gurney, Maclaren Cooling Towers – (London)
4. A.P. Frass and M.N. Ozisik, Heat Exchanger Design- John Wieley& Sons, New York
5. Arora&Domkundwar.,Heat and mass transfer by Dhanpat Rai and Company
6. Stoecker, Refrigeration & Air-Conditioning by McGrawHill Company
7. Dossat, Refrigeration & Air Conditioning by Prentice Hall of India Company

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M.Tech. (II Sem.)	17TE13 - OPTIMIZATION METHODS IN ENGINEERING	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Mathematics

Course Objective: Introduce the concepts of numerical optimization algorithms and formulate the engineering design problems as a mathematical optimization problem.

Course Outcomes: At the end of the course the student able to

- CO1 Demonstrate knowledge and understanding of the basic ideas underlying optimization techniques.
- CO2 Demonstrate knowledge and understanding of some of the most common standard optimization models.
- CO3 Develop mathematical optimization models for a range of practical problems.
- CO4 Formulate large-scale linear and integer programming problems and then solve the problem.
- CO5 Solve complex thermal engineering problems by using mathematical models.

UNIT - I

LINEAR PROGRAMMING: Introduction to Linear Programming, Two phase Simplex method, Big-M method ,duality, interpretation, applications.

UNIT - II

ASSIGNMENT PROBLEMS: Hungarian's algorithm, Degeneracy, applications, unbalanced problems, travelling salesman problem.

CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization with and without constraints, multi-variable optimization without constraints, multi-variable optimization with constraints-method of Lagrange multipliers, Kuhn- Tucker conditions.

UNIT -III

NUMERICAL METHODS FOR OPTIMIZATION: Nelder Mead's Simplex search method, Gradient of a function, steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - IV

GENETIC ALGORITHM (GA): Introduction, Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA.

UNIT - V

APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

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Dept. of Mechanical Engineering
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REFERENCES

1. Rao, S. S., Optimization Theory and Applications, Wiley Eastern Ltd., 2nd Edition, 2004.
2. Fox, R. L., Optimization Methods for Engineering Design, Addison Wesley, 2001.
3. JasbirArora, Optimal design McGraw-Hill Publishers
4. Kalyanmoy Deb, Optimization for Engineering Design- PHI publishers
5. S.S.Rao, Engineering Optimization- New Age Publishers
6. D.E. Goldberg, Genetic algorithms in Research, Optimization and Machine learning- Addison Wesley Publishers
7. J.R.Koza,M.A.keane,J.Yu,F.H.Bennett, Genetic Programming, 2000-Springer

M.Tech. (II Sem.) **17TE14 - JET AND ROCKET PROPULSION**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Thermodynamics, IC engines and Gas turbines

Course Educational Objectives: This course provides the concepts jet and rocket propulsion. In this course, the concepts of air breathing engines, construction, performance of different combustors and nozzles used in rockets are discussed and the performance of jet engines and rockets are analyzed. Finally, the suitability of solid and liquid propellants in rocket engines are demonstrated.

Course Outcomes: At the end of the course the student able to:

- CO1 Apply the principles of air breathing engines and jet propulsion.
- CO2 Demonstrate the construction, function, performance and efficiency of different combustors and nozzles used in rockets.
- CO3 Analyze the performance of jet engines and rocket vehicles.
- CO4 Distinguish the properties of solid and liquid propellants.
- CO5 Acquire the fundamental knowledge of solid and liquid propellants used in rockets

UNIT-I

PRINCIPLES OF JET PROPULSION: Introduction, Fundamentals of jet propulsion.
AIR-BREATHING ENGINES: Introduction, Thermodynamics of Aircraft Jet Engines- Turbo jet, Turbo fan, Turbo prop, and Ramjet engines, Typical Engine Performance.

UNIT-II

AERO THERMODYNAMICS OF INLET, COMBUSTORS AND NOZZLES: Introduction, Subsonic Inlets, Supersonic Inlets, Gas Turbine Combustors, After burners and Ram jet Combustors, Supersonic Combustion, Exhaust Nozzles.

UNIT-III

PERFORMANCE OF ROCKET VEHICLES: Introduction, Static Performance, Vehicle Acceleration, Gravity-Free Drag-Free Space Flight, Forces Acting on a Vehicle in the Atmosphere, Basic Relations of Motion, Space Flight, Flight Maneuvers, Effect of Propulsion System on Vehicle Performance, Flight Vehicles, Military Missiles, Flight Stability, Chemical Rockets.

UNIT-IV

LIQUID PROPELLANTS: Propellant Properties, Liquid Oxidizers, Liquid Fuels, Liquid Monopropellants, Gelled Propellants, Gaseous Propellants, Safety and Environmental Concerns.
SOLID PROPELLANTS: Classification, Propellant Characteristics, Hazards, Propellant Ingredients, Other Propellant Categories, Liners, Insulators, and Inhibitors, Propellant Processing and Manufacture.

UNIT-V

LIQUID PROPELLANT ROCKET ENGINE FUNDAMENTALS: Types of Propellants, Propellant Tanks, Propellant Feed Systems, Gas Pressure Feed Systems, Tank Pressurization, Turbo-pump Feed Systems and Engine Cycles.
SOLID PROPELLANT ROCKET FUNDAMENTALS: Basic Relations and Propellant Burning Rate, Other Performance Issues. Propellant Grain and Grain Configuration, Propellant Grain Stress and Strain, Attitude Control and Side Manoeuvres with Solid Propellant Rocket.

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REFERENCES

1. Philip Hill and Carl Peterson Mechanics and Dynamics of Propulsion, Addison-Wesley.
2. P.Sutton & Oscar Billarz Rocket Propulsion Elements, John Wiley & sons.
3. Martin J.L. Turner, Rocket and Spacecraft Propulsion, Springer publications.
4. Sarvanamuttoo, H.I.H., Rogers, G. F. C. and Cohen, H., Gas Turbine Theory, 6th Edition, Pearson Prentice Hall, 2008.
5. Ganesan, V., Gas Turbines, 3rd Edition, Tata McGraw Hill, 2010.
6. Yahya, S. M., Turbines, Compressors and Fans, 4th Edition, Tata McGraw Hill, 2010.

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M.Tech. (II Sem.)	17TE15 - GAS TURBINE THEORY	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Thermodynamics, Fluid mechanics, Engineering chemistry

Course Objective: In this course student will learn about to understand fundamentals of gasturbines, real cycles, centrifugal compressors, combustion analysis and modern gasturbines

Course Outcomes: After completion of the course students are able to:

- CO1 Solve the basic problems in gasturbines cycles
- CO2 Conduct performance analysis on real cycles on various parameters
- CO3 Evaluate the performance of centrifugal compresors on various parameters
- CO4 Analyze the combustion process and emissions in combustion systems
- CO5 Comprehend of the different advanced gas turbines like axial and radial flow turbines and their function

UNIT-I

Introduction: Classification of Gas Turbines, Applications of Gas Turbines, Simple Brayton Cycle, methods to improving gas turbine cycle efficiency, Heat Exchange Cycle, Inter-cooling and Reheating Cycle, Comparison of Various Cycles. Assumptions for Air-Standard Cycles.

UNIT-II

Real Cycles and their Analysis: Methods of Accounting for Component Losses, Isentropic and Polytropic Efficiencies, Transmission and Combustion Efficiencies, Comparative Performance of Practical Cycles, Combined Cycles and Cogeneration Schemes.

UNIT-III

Centrifugal Compressors: Construction and Principle of Operation, Elementary Theory and Velocity Triangles, Factors Effecting Stage Pressure Ratio, The Diffuser, The Compressibility Effects, Pre-rotation and Slip Factor, Surging and Choking, Performance Characteristics.

UNIT-IV

Combustion System: Operational Requirements, Classification of Combustion Chambers, Factors Effecting Combustion Chamber Design, The Combustion Process, Flame Stabilization, Combustion Chamber Performance, Some Practical Problems Gas Turbine Emissions.

UNIT-V

Axial and Radial Flow Turbines: Construction and Operation, Vortex Theory, Estimation of Stage Performance, Overall Turbine Performance, The Radial Flow Turbine.
Off-Design Performance: Off-Design Performance of Single Shaft Gas Turbine, Off-Design Performance of Free Turbine Engine, Methods of Displacing the Equilibrium Running Line.

TEXTBOOKS

1. Sarvanamuttoo, H.I.H., Rogers, G. F. C. and Cohen, H., Gas Turbine Theory, 6th Edition, Pearson Prentice Hall, 2008.
2. Dixon, S.L., Fluid Mechanics and Thermodynamics of Turbo machinery, 7th Edition, 3. Elsevier, 2014. 3. Flack, R.D., Fundamentals of Jet Propulsion with Applications, Cambridge University Press, 2011.

REFERENCES

1. Ganesan, V., Gas Turbines, 3rd Edition, Tata McGraw Hill, 2010.
2. Yahya, S. M., Turbines, Compressors and Fans, 4th Edition, Tata McGraw Hill, 2010.
3. Lefebvre, A.H., Gas Turbine Combustion, CRC Press, 2010

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M.Tech. (II Sem.)	17TE16 - REFRIGERATION AND CRYOGENICS	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Thermodynamics

Course Educational Objectives (CEOs): This course provides simple understandings of refrigeration, air conditioning and cryogenics fundamentals. It covers the different refrigeration cycles and its analysis and also the concepts of psychrometry and psychrometry process used for the purpose of air conditioning. Further, the comfort air conditioning and cooling load design and estimation also addressed in this course. It also covers the basic principles of cryogenics and related systems.

Course Outcomes (COs): At the end of the course, the student will be able to :

- CO1 Describe various concepts of refrigeration and its applications
- CO2 Evaluate the performance parameters of refrigeration systems
- CO3 Comprehend the VAR and non-conventional refrigeration methods
- CO4 Estimate the cooling load design for thermal comfort conditions
- CO5 Understand the basic principles of cryogenics

UNIT - I

REFRIGERATION: Introduction-Necessity and applications, unit of refrigeration, Heat Engine, Refrigerator and Heat Pump-C.O.P and Types of Refrigeration.

AIRCRAFT REFRIGERATION SYSTEM: Necessity of Aircraft Refrigeration – Advantages of Air cycle for Aircraft Refrigeration – Classification of Aircraft Refrigeration Systems –Simple air craft Bootstrap– Regenerative air refrigeration systems

REFRIGERANTS: A survey of Refrigerants-Nomenclature, Desirable properties-Classification of Refrigerants – Alternate refrigerants – Ozone depletion potential and Global Warming Potential.

UNIT - II

VAPOUR COMPRESSION REFRIGERATION: Simple Vapour Compression refrigeration cycle, P-h charts, Factors affecting performance of VCR cycle, Actual VCR cycle

MULTISTAGE VAPOUR COMPRESSION SYSTEMS: Introduction-Multi stage or Compound Compression-Multi Evaporator system-Cascade System.

UNIT - III

VAPOUR ABSORPTION REFRIGERATION SYSTEM: Description and working of simple and actual Aqua-Ammonia system-Maximum COP-Li-Br Water system-Three fluid Vapour absorption refrigeration system-Applications

NON-CONVENTIONAL REFRIGERATION METHODS: Principle and operation of (i) Thermoelectric refrigeration (ii) Vortex tube or Hilsch tube (iii) Adiabatic demagnetization (iv) Steam jet refrigeration system.

UNIT - IV

INTRODUCTION TO AIR CONDITIONING: Psychometric properties and processes, Construction of psychometric chart -Requirements of Comfort Air conditioning – Thermodynamics of human body, summer, winter and Year round air conditioning systems-Cooling load estimation.

DESIGN OF AIR CONDITIONING SYSTEMS: All fresh air, Re-circulated air with and without bypass- factor -ADP, RSHF, GSHF& ESHF for different systems

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UNIT - V

CRYOGENICS : Introduction , Joules Thomson effect, production of dry ice, liquefaction of Hydrogen, Liquefaction of helium, Linde system, Claude system & its analysis, application of cyrogenics.

REFERENCES

1. C. P. Arora. ,Refrigeration and air conditioning - TMH, 2nd Edition,2000.
2. R. Dossat, Principles of Refrigeration - - Pearson ,4th Edition 2001
3. Randal Barron " Cryogenics systems", McGraw Hill,2000.
4. C.P.Arora,"Refrigeration and air conditioning" –, Tata McGraw-Hill, 2001.
5. Arora & Domkundwar " Refrigeration & Air Conditioning" -– Dhanpat Rai & Co.
6. Manohar Prasad, "Refrigeration and Air Conditioning"-, New Age International, 2003.
7. Roy J. Dossat ,"Principles of refrigeration"-. Prentice Hall, 1996.
8. Wilbert F. Stoecker, "Refrigeration and air conditioning"- r, Jerold W. Jones, MGH, 1986.
9. Anantha Narayana ,"Refrigeration & Air Conditioning" Tata McGraw-Hill, 2001.

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M.Tech. (II Sem.)

17TE17 - MEASUREMENTS IN THERMAL ENGINEERING

L	T	P	Cr.
3	-	-	3

Pre-requisites : Instrumentation

Course Educational Objectives: To familiarize the various methods of measuring temperature, pressure and velocity using advanced techniques.

Course Outcomes: At the end of this course each student will be able to

- CO1 Understand the concepts of temperature measurements.
- CO2 Comprehend the various techniques of pressure measurement.
- CO3 Apply the various principles for velocity measurement.
- CO4 Identify the Analog methods used in Electro-Mechanical Systems.
- CO5 Analyse the digital techniques in Mechanical Measurements.

UNIT – I

TEMPERATURE MEASUREMENT: Introduction, Pressure thermometers, Thermocouples-Measurement of Thermal EMF- RTD, Thermisters,- Total radiation Psychrometry –Errors resulting from conduction and Radiation-Measurement of Temperature in rapidly moving gas-Measurement of Heat Flux.

UNIT - II

PRESSURE MEASUREMENT TECHNIQUES: Introduction, Barometers, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics, Flow direction measurement probes and Low Pressure Measurement Gauges

UNIT - III

VELOCITY MEASUREMENT: Introduction, Velocity & Mach number from pressure measurements, Laser droplet anemometer- LDA Principle, Doppler shift equation, Reference beam system, Fringe system. Measurement of velocity by Hot-Wire Anemometer, Measurement of velocity using vortex shedding Technique, Fluid Jet Anemometer, Mass & volume flow measurement

UNIT - IV

ANALOG METHODS: Introduction, Hale-Shaw Apparatus, Electrolytic Tank, Hydraulic Analogy, Hydraulic Jumps -Simple Harmonic Relations-circular and cyclic Frequency

UNIT - V

DIGITAL TECHNIQUES IN MECHANICAL MEASUREMENTS: Fundamental Digital Circuit Elements, Binary Codes , Simple Digital Circuitry-Digital computer as a measurements system tool-Data Processors, Microcomputers-Analog to Digital and Digital to Analog Conversion

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REFERENCES

1. Bechwith-Marangoni-Lienhard –Mechanical Measurements –5th Edition
2. E. Rathakrishnan, Instrumentation, Measurements and Experiments in Fluids, CRC press, 2007.
3. Jack Philip Holman, Walter J. Gajda, Experimental methods for Engineers, 4th Edition: McGraw-Hill, 1984.
4. Ernest, O. D., Measurement Systems - Applications and Design, Tata McGraw Hill Book Company, New Delhi, 2011
5. Beckwith, Nelson Lewis Buck, Mechanical Measurements, Thomas GE 5th Edition: Wesley Pub. Co., 1961.
6. Holman, J. P., Experimental Methods for Engineers, Tata McGraw Hill Book Company, New Delhi, 2010.

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M.Tech. (II Sem.) **17TE18 - FUEL CELL TECHNOLOGY**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Thermodynamics, Fluid mechanics, Engineering chemistry

Course Objective: The main objective of this course is to understand the principle of operation and constructional features of fuel cells.

Course Outcomes: After completion this course, student will be able to

- CO1 Acquire the basic knowledge of principle of operation of fuel cell technology.
- CO2 Understand the electrochemistry of fuel cells.
- CO3 Analyze the characteristics of fuel cell systems.
- CO4 Design a fuel cell system.
- CO5 Apply the economics of fuel cell technology.

UNIT - I

Introduction to the principles and operation of fuel cell technology-Fundamental aspects of fuel cell systems-Types of fuel cells- Stack configurations-Relative advantages and disadvantages of different types of fuel dells.

UNIT - II

Electrochemistry of fuel cells- Introduction-General characteristics of principal types of fuel cells-Thermodynamics and electrode kinetics of fuel cells-Elements of the fuel cells.

UNIT - III

Characteristics of fuel cell systems- Efficiency-Cell efficiency-Carnot machines and fuel cells-Part load characteristics-Response time, Spinning reserve capability-Emissions-Modularity-Life time-Safety and Materials.

UNIT - IV

System design and Optimization- Introduction- The importance of fuel cell system Integration-The Design of a fuel cell systems- The optimization of a fuel cell systems- Load response-Cogeneration

UNIT - V

Fuel cell system economics-Introduction-Installed cost estimating and cost reduction-Sensitivity analyses- Comparison with conventional power generation technologies

REFERENCES

1. Fuel Cell System, edited by Leo J.M.J. Blomen and michael N. Mugerwa, New York, Plenum Press, 1993.
2. Fuel Cell Handbook, by A. J. Appleby and F. R. Foulkers, Van Nostrand, 1989.
3. Fuel Cell Handbook, by EG & G Technical services , Inc

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M.Tech. (II Sem.) **17TE62 - RENEWABLE ENERGY TECHNOLOGY LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites : Non conventional sources of energy

Course Educational Objectives: This laboratory is mainly focused to make the students to understand the basic concepts involved in solar thermal systems, i.e., Flat plate collector, concentrator and solar PV systems and its calculation procedures.

Course Outcomes: After the completion of the course, students should be able to

- CO1 Understand the principles of renewable energy conversion techniques.
- CO2 Estimate the performance characterstics of renewable energy devices.
- CO3 Acquire the knowledge to improve the performance of renewable energy devices.
- CO4 Comprehend the performance parameters of the renewable energy devices .

List of Experiments

1. To evaluate the performance of a solar parabolic trough system under different atmospheric and design parameters with water and oil used as working fluids.
2. The solar PV training system covers the fundamentals of solar PV system as well as basic research on PV system
3. A Solar Grid-tied System is a grid connected PV system which links solar power generated by the PV modules to the mains.
4. Solar PV Emulator is a programmable power supply designed to emulate solar panels.
5. Efficiency and other transport measurements in the presence of light of photovoltaic modules, materials and devices
6. Effects of temperature of PEM Fuel cell and electrolyser system.
7. Comparing the effects of electrical load on fuel cell and rechargeable batteries
8. Compare the polymer Electrolyte Membrane and Direct Methanol fuel cells
9. Study of renewable energy cost analysis on solar, wind, photovoltaic cells
10. Biomass energy converter

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L	T	P	Cr.
-	-	2	1

M.Tech. (II Sem.) **17TE63 - COMPUTATIONAL METHODS LAB**

Course Objective: To solve the problems of fluid flow and heat transfer and build up the skills in the actual implementation of CFD methods for 1D and 2D heat conduction and convection problems and acquire skills in thermal analysis of the same.

Course Outcomes: After the completion of the course, students should be able to

CO1	Develop codes for numerical methods to tackle simple problems.
CO2	Build up the skills in the actual implementation of CFD methods (1D and 2D heat conduction and convection problems) by attempting to write their own codes.
CO3	Analyze and validate output of written codes with analytical solution.
CO4	Obtain experience in the application of CFD analysis to real engineering designs.

List of Experiments

1) Steady state heat transfer analysis through circular fins
2) Steady state heat transfer analysis of a heat sink
3) Steady state thermal analysis of a steel bar
4) Steady state thermal analysis of a cylinder
5) Steady state heat transfer analysis through composite slab
6) Transient thermal analysis of convection of bar in air
7) A turbulent fluid flow and heat transfer problem in a mixing elbow using Ansys fluent
8) Fluid flow analysis of a radiator using Ansys fluent
9) Fluid flow fluent analysis of a helical coil
10) Fluid flow fluent analysis of two phase flow in a Horizontal pipe
11) Analysis of water flow in a converging pipe using Ansys fluent
12) Analysis of two dimensional laminar flow using Ansys fluent

M.Tech. (II Sem.)	17TE51 - MINI PROJECT	L	T	P	Cr.
		-	-	2	1

Pre-requisites : Knowledge in theory courses studied in First and Second Semesters

Course Educational Objective: To make the students plan and execute a mini project independently using the available resources in the institute.

Course Outcomes: After the completion of the course, students should be able to

CO1 Plan a technical task based on the domain of problem

CO2 Translate ideas in solving thermal problems by simulation work or making a working model

CO3 Develop the ability to execute a mini project independently

CO4 Prepare a well organized technical report

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M.Tech. (II Sem.)	17TE91 - FUELS, COMBUSTION AND ENVIRONMENT	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Engineering chemistry, Environmental science and thermodynamics

Course Educational Objectives: To learn about different types of fuels and their applications, principles in combustion process, thermodynamics of flame propagation and order of chemical reactions, effect of emissions on human health and environmental conditions.

Course Outcomes: At the end of the course the student will be able to

- CO1 Comprehend the various fuels and their combustion characterstics
- CO2 Evaluate the combustion characterstics of different fuels
- CO3 Understand the principles in combustion process
- CO4 Estimate the power developed in the chemical reaction of fuels
- CO5 Analyze the impact of automobile emissions on human health and environmental conditions

UNIT – I

Fuels – Detailed classification– Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal. Coal – Carbonization, Gasification and liquification – Types of coals-Lignite, Anthracite, Bituminous, Peat : petroleum based fuels – problems associated with very low calorific value gases; Coal Gas – Blast Furnace Gas, Alcohols and Biogas.

UNIT – II

Principles of combustion– Chemical composition – Flue gas anlaysis – dew point of products – Combustion stoichiometry.

UNIT-III

Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroeth, First, Second and Third order reactions - complex reactions – chain reactions. Theories of reaction- Kinetics – General oxidation behavior of HC's.

UNIT – IV

Thermodynamics of combustion– Enthalpy of formation – Heating value of fuel - Adiabatic flame Temperature – Equilibrium composition of gaseous mixtures.

Laminar and turbulent flames propagation and structure– Flame stability – Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity.

UNIT – V

Environmental considerations – Automobile Emissions - Air pollution – Effects on Environment, Human Health etc. Principal pollutants – Legislative Measures – Methods of Emission control.

REFERENCES

1. Combustion Fundamentals, Roger A, Strehlow, Mc Graw Hill
2. Fuels and combustion, Sharma and Chander Mohan, Tata Mc Graw Hill
3. Combustion Engineering and Fuel Technology , Shaha A.K., Oxford and IBH.
4. Principles of Combustion, Kanneth K.Kuo, Wiley and Sons.
5. An Introduction to Combustion, Stephen R. Turns, Mc. Graw Hill International Edition.
6. Combustion Engineering, Gary L. Berman & Kenneth W. Ragland, Mc. Graw Hill International Edition.

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M.Tech. (III Sem.) **17TE19 - WASTE HEAT RECOVERY SYSTEMS**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Thermal engineering

Course Objective: To provide students knowledge of waste heat potential, its effective recovery based on economic analysis, energy storage using various waste heat recovery methods and devices.

Course Outcomes: At the end of the course the student will be able to

CO1	Comprehend the Rankine cycle, coupled cycles for combined plants for energy conservation.
CO2	Analyze the waste heat recovery technologies developed for various thermal systems.
CO3	Acquire knowledge on waste heat recovery in heat pump, thermoelectric and HVAC systems.
CO4	Apply the economic analysis concepts for the effective implementation of waste heat recovery.
CO5	Identify the need for various energy storage systems in waste heat recovery applications.

UNIT-I

Introduction: Rankine cycle, coupled cycles and combined plants, energy resources and use, potential for energy conservation, optimal utilization of fossil fuels, total energy approach.

UNIT-II

Waste heat recovery systems selection criteria for waste heat recovery technologies-recuperators-regenerators-economizers-plate heat exchangers-thermic fluid heaters-Waste heat boilers-classification, location, service conditions, design considerations-fluidized bed heat exchangers-heat pipe exchangers-heat pumps –sorption systems.

UNIT-III

Prime Mover Exhausts; incineration plants; heat pump systems; thermoelectric devices. Utilization of low grade reject heat from power plants, Utilization of waste heat in refrigeration, heating, ventilation and air conditioning systems. Thermoelectric system to recover waste heat.

UNIT-IV

Energy Storage Systems: Need for energy storage, Thermal, electrical, magnetic and chemical storage systems.

UNIT-V

Economic Analysis Investment cost –economic concepts–measures of economic performance –procedure for economic analysis–examples–procedure for optimized system selection and design–load curves -sensitivity analysis –regulatory and financial frame work for cogeneration and waste heat recovery system.

REFERENCES

1. Parker, Colin & Roberts, Energy from Waste1985 An Evaluation of Conversion Technologies Elsevier Applied Science
2. Shah, Kanti L.,(2000) Basics of Solid & Hazardous Waste Management Technology, Prentice Hall of India.
3. Manoj Datta,(1997)Waste Disposal in Engineered Landfills , Narosa Publishing House.
4. Rich, Gerald et.al.,(1987) Hazardous Waste Management Technology, Podvan Publishers.
5. Bhide AD., Sundaresan BB,(1983) Solid Waste Management in Developing Countries, INSDOC New Delhi.

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M.Tech. (III Sem.)

17TE20 - CONVECTIVE HEAT AND MASS TRANSFER

L	T	P	Cr.
3	-	-	3

Pre-requisites : Thermodynamics, Heat transfer

Course Educational Objectives:

This course provides the concepts of convective heat and mass transfer. It covers the concepts such as forced and natural convection, two phase heat transfer phenomena and their application in problem solving of the thermal systems. Moreover, the basics of mass transfer and convective mass transfer phenomena are discussed.

Course Outcomes: At the end of the course the student able to:

CO1	Acquainted with the advanced topics of forced convective heat transfer occurring in real world problems.
CO2	Describe the concepts of natural convective heat transfer analysis of different thermal systems.
CO3	Demonstrate the concepts of phase change heat transfer in solving the problems.
CO4	Acquire the knowledge of basics of mass transfer.
CO5	Familiarize with the concepts of convective mass transfer and apply the knowledge in problem solving.

UNIT - I

INTRODUCTION: Convection, review of conservation equations - Forced convection in laminar flow -Exact and approximate solutions of Boundary layer energy equation for plane isothermal plate in longitudinal flow - problems.

FORCED CONVECTION: heat transfer in laminar tube flow - forced convection in turbulent flow – Internal Flows-Correlations-Problems.

UNIT - II

FREE CONVECTION: Approximate analysis of laminar free convective heat transfer on a vertical plate-external flows-correlations-problems.

UNIT - III

BOILING AND CONDENSATION: Analysis of film condensation on a vertical surface – pool boiling - forced convection boiling inside tubes - problems.

UNIT - IV

MASS TRANSFER: Definitions of concentration and velocities relevant to mass transfer, Fick's law, species conservation equation in different forms. Steady state diffusion in dilute solutions in stationary media, transient diffusion in dilute solutions in stationary media, one dimensional non dilute diffusion in gases with one component stationary.

UNIT - V

CONVECTIVE MASS TRANSFER: Governing equations-forced diffusion from flat plate-Dimension less correlation's for mass transfer. Simultaneous heat and mass transfer - analogy between heat, mass and momentum transfer.

REFERENCES

1. Bejan, A., Convection Heat Transfer, 3rd Edition, Wiley India, 2006.
2. Louis, C. Burmeister, Convective Heat Transfer, John Wiley and Sons, New York, 2002.
3. Kays, W. M. and Crawford, M. E., Convective Heat and Mass Transfer, 4th Edition, Tata McGraw Hill, 2012.
4. Necati Ozisik Heat Transfer, Tata McGraw Hill, 1985
5. V.Gupta and I.Srinivasan, Heat and Mass transfer, Tata McGraw Hill

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M.Tech. (III Sem.)

17TE21 - HEATING, VENTILATING AND AIR-CONDITIONING

L	T	P	Cr.
3	-	-	3

Pre-requisites : Heat transfer, Refrigeration and air conditioning, Thermodynamics

Course Educational Objective: In this course student will learn about to understand fundamentals of Psychrometry, air conditioning devices, human requirements, ventilation systems, ventilation load calculations.

Course Outcomes: At the end of the course the student will be able to

- CO1 Estimate the cooling load in air conditioning area by using psychometric relations
- CO2 Suggest a suitable air conditioning devices for the need of human requirements
- CO3 Comprehen d the components in ventilation system
- CO4 Design a suitable ventilation system in the field of air conditioning
- CO5 Estimate the amount of heat exchange from the air conditioning area to the surroundings

UNIT – I

Psychometric: Psychometric properties and processes – Construction of Psychometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature.
Air–conditioning Systems: All Fresh air, Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP,RSHF, ESHF and GSHF for different systems.

UNIT – II

Cooling load Estimation: Occupants, equipments, heat gain due to- infiltration, fan load, Fresh air load (Ventilation). Summer, winter and year round air – conditioning systems.
Components: Humidification and dehumidification equipment – Systems of Air cleaning – Measurement and control of Temperature and Humidity.

UNIT – III

Ventilation systems: Natural ventilation systems – Mechanical – Extraction system – Supply systems – Combined supply and extraction systems, Grills and diffusers – Fans and blowers.– Air cleaning – Equipment used for odour suppression and air sterilization.

UNIT – IV

Ventilation of Commercial Building: Design of commercial, Residential ventilation system.

UNIT – V

Heating: Building Survey-location of equipment, Heat gain through glass-calculation of solar heat gain through ordinary glass tables, Thermal resistance of various building materials.
Heat Transfer through Building Structures: Periodic heat transfer through walls and roofs. Empirical methods to calculate heat transfer through walls and roofs using decrement factor and time lag method. Equivalent temperature difference method. Infiltration tack effect-wind effect.

TEXTBOOKS

1. Ventilation Systems: Design and Performance/ Hazim B. Awbi. / Routledge / 2007.
2. Refrigeration & Air Conditioning / C.P.Arora / TMH
3. Refrigeration & Air Conditioning / Arora & Domkundwar / Dhanpat Rai & Co.

REFERENCES

1. HVAC Fundamentals Volume-1 / James E. Brumbou / Audel / 4th Edition
2. Fundamentals of HVAC Systems / Robert Mcdowall / Academic Press / 2007
3. Home Heating & Air Conditioning systems / James Kittle / MGH

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M.Tech. (III Sem.)	17TE22 - ENERGY CONSERVATION AND MANAGEMENT	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Industrial management, Thermal engineering

Course Objective: To provide students an insight of principles and opportunities of energy conservation in thermal, electrical domains through energy audit and its effective management on the grounds of economy and waste heat recovery.

Course Outcomes: At the end of the course the student able to

CO1 Acquire the fundamental principles, objectives and rules of energy conservation in buildings.

CO2 Evaluate the energy efficiency in thermal and electric utilities.

CO3 Comprehend the energy audit procedures for energy conservation and management.

CO4 Analyze the economic feasibility of energy conservation programmes.

CO5 Get awareness on the climate policy and associated developments around the globe.

UNIT - I

Energy conservation: Principles of energy conservation, Energy Conservation Act 2001 and its features, Electricity Act-2003 & its features, Energy consumption pattern, Resource availability, Energy pricing, Energy Security, Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope, Evaluation of the overall thermal transfer

UNIT - II

Energy efficiency in thermal utilities: Energy efficiency in boilers, furnaces, steam systems, cogeneration utilities, waste heat recovery, compressed air systems, HVAC&R systems, fans and blowers, pumps, cooling tower

Energy efficiency in electrical utilities: Energy efficiency for electric motors, lighting systems, Characteristics of Light, Types of Lighting, Incandescent Lighting, Fluorescent Lighting, Vapor Lighting, Street Lighting, LED Lighting, Lighting Design, Light Dimming, Tips for Energy Conservation, Products for Energy Conservation in lighting system

UNIT - III

Energy Audit: Definition, objective and principles of Energy Management, Need of Energy Audit and Management, types of energy audit, audit process, Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable energy on energy audit recommendations and energy audit report, energy audit of building system, lighting system, HVAC system, Water heating system, heat recovery opportunities during energy audit, Industrial audit opportunities, Instruments for Audit and Monitoring Energy and Energy Savings

UNIT - IV

Energy Economics: Simple Payback Period, Time Value of Money, Internal Rate of Return, Net Present Value, Life Cycle Costing, Equivalent uniform annual cost (EUAC), Life cycle cost, Discounting factor, Capital recovery, Depreciation, taxes.

UNIT - V

Climate Policy: Kyoto protocol, Clean development mechanism (CDM), Geopolitics of GHG control; Carbon Market

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REFERENCES

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994

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M.Tech. (III Sem.) **17TE23 - RADIATIVE HEAT TRANSFER**

L	T	P	Cr.
3	-	-	3

Course objectives: This course is designed to introduce basic fundamental principles of radiative heat transfer. the phenomena of radiation heat transfer, to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes. As well, to knowledge in scattering mechanism of heat transfer

Course outcomes: At the end of the course, the student will be able to:

CO1 Demonstrate the basic principles of thermal radiation.

CO2 Evaluate the radiation heat exchange between gray body surfaces.

CO3 Understand the fundamentals of gas radiation.

CO4 Comprehend emissivity and associated laws of emissivity measurement

CO5 Examine the scattering mechanism in radiative heat transfer

UNIT - I

Properties of Surfaces: Introduction, Applications of Thermal Radiation, Nature of Thermal radiation-Emissive power-Absorption, Reflection and Transmission, Blackbody radiation, Laws of Black Body Radiation- Radiation from Non black surfaces Properties of real surfaces, Spectral and directional variations

UNIT - II

Radiation exchange between surfaces: : Introduction, Shape factor, Triangular enclosure, Evaluation of shape factors, Radiation in enclosures, Radiation shields, Electrical analogy, Applications, Non-gray enclosures, Enclosure with Specular surfaces, integral method for enclosures.

UNIT - III

Gas Radiation: Introduction to gas radiation, Plane parallel model, Diffusion approximation, Radiative equilibrium, optically thick limit, Radiation spectroscopy

UNIT - IV

Emissivity: Introduction to emissivity, Kirchhoff's law, Isothermal gas emissivity, Band models, Total Emissivity method, isothermal gas enclosures, Well-stirred furnace model, Gas radiation in complex enclosures, Interaction between radiation and other modes of heat transfer, Radiation heat transfer during flow over flat plate

UNIT - V

Scattering: Radiation and Climate, Radiative-convective equilibrium, Radiative equilibrium with scattering, Radiation measurement, Radiation with internal heat source, Particle scattering, Scattering in the atmosphere, Non-isotropic scattering, Monte Carlo method.

REFERENCES

1. Siegel, R. and Howell, J., Thermal Radiation Heat Transfer, Taylor and Francis 2002.
2. R.C.Sachdeva -Fundamentals of Engineering Heat and Mass Transfer —New Age Intl. Publishers 2nd Edition, 2005
3. Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012
4. J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010
5. P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007
6. P.S.Ghoshdastidar Heat Transfer - Oxford Higher Education 6th Edition 2011.

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M.Tech. (III Sem.) **17TE24 - TWO PHASE FLOW AND HEAT TRANSFER**

L	T	P	Cr.
3	-	-	3

Pre-requisites : Thermodynamics, Heat transfer

Course Educational Objectives: This course provides the concepts of two phase flow and heat transfer phenomena. It covers the concepts of multiphase flows by giving more stress towards the two phase flow systems. Moreover, this course imparts the knowledge of the concepts of multiphase heat transfer phenomenon such as boiling and condensation.

Course Outcomes: After the completion of this course, the student will be able to:

CO1 Describe the basic concepts of multiphase flows and their applications.

CO2 Demonstrate the different flow regimes and their characteristics in two phase flow systems.

CO3 Distinguish the different types of two phase flow systems.

CO4 Acquire the fundamental and advanced knowledge of the boiling heat transfer phenomenon.

CO5 Accustom to the concepts of condensation heat transfer phenomenon.

UNIT-I

INTRODUCTION: Introduction to multiphase flows, types and applications, common terminologies, flow patterns and flow pattern maps.

UNIT-II

TWO PHASE FLOWS: Introduction, Flow regimes, Homogeneous flow, Drift flux, Separated flow, Bubbly, Slug, Annular and Stratified flow, Measurement of void fractions and pressure drop in two phase flows.

UNIT-III

DIFFERENT TWO PHASE FLOW SYSTEMS: Signal Analysis, Two Fluid-Population Balance Technique, Volume of Fluid Method, Lattice Boltzmann Model, and Smoothed article Hydrodynamics, Molecular Dynamics, Solid-Liquid Flow, Gas-Solid-Flow.

UNIT-IV

BOILING HEAT TRANSFER: Introduction, General features, Nucleation and bubble dynamics, Pool boiling heat transfer, Critical heat flux in pool boiling, Heat transfer in flow boiling, Critical heat flux in flow boiling.

UNIT-V

CONDENSATION HEAT TRANSFER: Introduction, Film and drop-wise condensation, Nusselt's theory of condensation, Deviations from Nusselt's theory, Condensation on horizontal tubes and tube banks, Condensation inside tubes, Turbulence in tube condensation, Flooding of condensers.

REFERENCES

1. Sarit K Das, Process heat transfer, Narosa publishing inc.
2. Collier, J.G. and Thome, J. R., Convective Boiling and Condensation, 3rd ed., Oxford University Press.
3. Ghiaasiaan, S.M., Two-Phase flow, Boiling, and Condensation, Cambridge University Press.
4. Brennen, C.E., Fundamentals of Multiphase Flow, Cambridge University Press.
5. Wallis, G.B., One Dimensional Two Phase Flow, McGraw Hill Higher Education.
6. Hewitt, G.F., Measurement of Two Phase Flow Parameters, Academic Press Inc.
7. Whally, P.B. Two-phase flow and Heat Transfer, Oxford Chemistry Primers.

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M.Tech. (III Sem.)	17TE52 - INTERNSHIP	L	T	P	Cr.
		-	-	-	2

Pre-requisites : Knowledge in the courses studied in first and second semester

Course Educational Objective: To make the students undergo internship training in a core industry independently and submit a report.

Course Outcomes: After the completion of the course, students should be able to

CO1 Apply the course concepts to take up a technical task in industry

CO2 Acquires the knowledge on the mechanism and process of the system/plant.

CO3 Develop the ability to interpret the technical data independently

CO4 Ability to prepare a well organized technical report.

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M.Tech. (III Sem.)	17TE53 - PROJECT WORK (PHASE-I)	L	T	P	Cr.
		-	-	20	10

Pre-requisites : Knowledge in the courses studied in first and second semester

Course Educational Objective: To make the students plan and execute a mini project independently using the available resources in the institute.

Course Outcomes: After the completion of the course, students should be able to

CO1 Identify a topic in advanced areas of thermal engineering

CO2 Review literature to identify gaps and define objectives & scope of the work

CO3 Employ the ideas from literature and develop research methodology

CO4 Develop a model, experimental set-up and / or computational techniques necessary to meet the objectives.

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M.Tech. (IV Sem.) **17TE54 - PROJECT WORK (PHASE-II)**

L	T	P	Cr.
-	-	32	16

Pre-requisites : Knowledge in the courses studied in first and second semester and the knowledge gained in executing the mini project

Course Educational Objective: To make the students plan and execute a mini project independently using the available resources in the institute.

Course Outcomes: After the completion of the course, students should be able to

CO1 Identify methods and materials to carry out experiments/develop code

CO2 Reorganize the procedures with a concern for society, environment and ethics

CO3 Analyze and discuss the results to draw valid conclusions

CO4 Prepare a report as per the recommended format and defend the work.

CO5 Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

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M.Tech. (IV Sem.) **17TE55 - COMPREHENSIVE VIVA VOCE**

L	T	P	Cr.
-	-	4	2

Pre-requisites : Knowledge in the courses studied in first and second semester

Course Educational Objective: To make the students plan and execute a mini project independently using the available resources in the institute.

Course Outcomes: After the completion of the course, students should be able to

CO1 Comprehend the knowledge gained in the course work

CO2 Infer principles of working of thermal energy systems

CO3 Demonstrate the ability in problem solving and to communicate effectively

CO4 Improve the overall confidence levels

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