REGULATIONS 2017

COURSE STRUCTURE

SYLLABUS

2 Years M.Tech Degree Programme

HEAT POWER AND THERMAL ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

(Affiliated to Biju Patnaik University of Technology, Rourkela)

Accredited by NAAC with 'A' Grade with a CGPA of 3.28/4.00

Regulation 2017

PROGRAMME EDUCATIONAL OBJECTIVES

Programme educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. Programme educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates of the program will have a successful career of mechanical engineering by imparting Mechanical Engineering concepts and practical knowledge.

PEO2: Graduates of the program will pursue higher education and research in the field of mechanical engineering.

PEO3: Graduates of the program will exhibit Scientific and Engineering expertise and perform as a Professional Entrepreneur.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Ability to apply the acquired Mechanical Engineering knowledge for the development of composite materials for societal application.

PSO 2: Ability to implement the learned principles of Mechanical Engineering to analyze, evaluate and create more advanced mechanical systems by using state-of-art facilities.

PROGRAMME OUTCOMES (POs)

PO-1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO-2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3. Design / Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO- 4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO- 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO- 6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO- 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO- 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO- 9. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11.Project management and finance: Demonstrate knowledge and understanding of the engineering management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO- 12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

SEMESTER WISE COURSE STRUCTURE

I SEMESTER								
S.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**QP**
THEORY								
1.	PC	MTEPC1010	ADVANCED FLUID MECHANICS	3	1	0	4	A
	PC	MTEPC1020	HEAT TRANSFER-1	3	1	0	4	A
	PC	MTEPC1030	ADVANCED REFRIGERATION ENGINEERING	3	1	0	4	A
2.	PE	MTEPE1041	INTERNAL COMBUSTION ENGINES	3	0	0	3	A
		MTEPE1042	ENERGY CONVERSION AND MANAGEMENT	3	0	0	3	A
		MTEPE1043	GAS DYNAMICS	3	0	0	3	A
		MTEPE1044	HYDEL POWER AND WIND ENERGY	3	0	0	3	A
3.	PE	MTEPE1051	SOLAR ENERGY TECHNOLOGY	3	0	0	3	A
		MTEPE1052	THERMAL AND NUCLEAR POWER PLANT	3	0	0	3	A
		MTEPE1053	RENEWABLE ENERGY SYSTEM	3	0	0	3	A
		MTEPE1054	DESIGN OF THERMAL SYSTEM	3	0	0	3	A
PRACTICAL								
1.	ES	MTEES1160	ENGINEERING SOFTWARE LABORATORY	0	0	8	4	
TOTAL				**15**	**3**	**8**	**22**	

II SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
THEORY								
1.	PC	MTEPC2010	ADVANCED ENGG THERMODYNAMICS	3	1	0	4	A
	PC	MTEPC2020	ADVANCED HEAT TRANSFER-II	3	1	0	4	A
2.	PE	MTEPE2031	COMPUTATIONAL FLUID DYNAMICS	3	0	0	3	A
		MTEPE2032	HEAT EXCHANGER ANALYSIS AND DESIGN	3	0	0	3	A
		MTEPE2033	COMPUTATIONAL METHODS IN THERMAL ENGINEERING	3	0	0	3	A
		MTEPE2034	EXPERIMENTAL METHODS IN THERMAL ENGINEERING	3	0	0	3	A
3.	PE	MTEPE2041	THEORY OF COMBUSTION AND EMISSION	3	0	0	3	A
		MTEPE2042	AIR CONDITIONING AND VENTILATION SYSTEMS	3	0	0	3	A
		MTEPE2043	GAS TURBINE AND JET PROPULSION	3	0	0	3	A
		MTEPE2044	BOILING,CONDENSATION AND TWO-PHASE FLOW	3	0	0	3	A
4.	PE	MTEPE2051	CRYOGENIC TECHNOLOGY	3	0	0	3	A
		MTEPE2052	AIRCRAFT AND ROCKET PROPULSION	3	0	0	3	A
		MTEPE2053	POWER PLANT AND PRACTICE	3	0	0	3	A
		MTEPE2054	FINITE ELEMENT METHODS IN THERMAL ENGINEERING	3	0	0	3	A
PRACTICAL								
1	ES	MTEES2160	ADVANCED THERMAL ENGG AND MEASUREMENT LABORATORY	0	0	8	4	
2	ES	MTEES2170	SEMINAR I	0	0	4	2	
TOTAL				**15**	**2**	**12**	**23**	

III SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
THEORY								
1.	OE	MTEOE3011	PROJECT MANAGEMENT AND COSTING	3	0	0	3	A
2.		MTEOE3012	RESEARCH METHODOLOGY	3	0	0	3	A
3.		MTEOE3013	HUMAN RESOURCE MANAGEMENT	3	0	0	3	A
PRACTICAL								
1.	ES	MTEES3120	THESIS I	0	0	36	18	
2.		MTEES4130	COMPREHENSIVE VIVA VOCE I	0	0	4	2	
TOTAL				**3**	**0**	**40**	**23**	

IV SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
PRACTICAL								
1.	ES	MTEES4110	SEMINAR II	0	0	4	2	
2.		MTEES4120	THESIS II	0	0	36	18	
3.		MTEES4130	COMPREHENSIVE VIVA VOCE II	0	0	4	2	
TOTAL				**0**	**0**	**44**	**22**	

STRUCTURE OF POST- GRADUATE (THERMAL ENGINEERING) PROGRAM

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER				TOTAL CREDITS
		I	II	III	IV	
1	Humanities and Social Sciences including Management Courses					
2	Basic Science Courses					
3	Engineering Science Courses including workshop, drawing, basics of electrical mechanical/computer etc.	4	4		2	**10**
4	Professional Core Courses	12	8			**20**
5	Professional Elective Courses relevant to chosen specialization / branch	6	9			**15**
6	Open subjects - Electives from other technical and/or emerging Subjects			3		**3**
7	Project work, Seminar and Internship in industry or elsewhere		2	20	20	**42**
8	Mandatory Courses [Environmental Sciences, Induction Training, Indian Constitution, Essence of Indian Traditional Knowledge]					
	TOTAL	**22**	**23**	**23**	**22**	**90**

I SEMESTER								
S.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**QP**
THEORY								
4.	PC	MTEPC1010	ADVANCED FLUID MECHANICS	3	1	0	4	A
		MTEPC1020	HEAT TRANSFER-1	3	1	0	4	A
		MTEPC1030	ADVANCED REFRIGERATION ENGINEERING	3	1	0	4	A
5.	PE	MTEPE1041	INTERNAL COMBUSTION ENGINES	3	0	0	3	A
		MTEPE1042	ENERGY CONVERSION AND MANAGEMENT	3	0	0	3	A
		MTEPE1043	GAS DYNAMICS	3	0	0	3	A
		MTEPE1044	HYDEL POWER AND WIND ENERGY	3	0	0	3	A
6.	PE	MTEPE1051	SOLAR ENERGY TECHNOLOGY	3	0	0	3	A
		MTEPE1052	THERMAL AND NUCLEAR POWER PLANT	3	0	0	3	A
		MTEPE1053	RENEWABLE ENERGY SYSTEM	3	0	0	3	A
		MTEPE1054	DESIGN OF THERMAL SYSTEM	3	0	0	3	A
PRACTICAL								
2.	ES	MTEES1160	ENGINEERING SOFTWARE LABORATORY	0	0	8	4	
TOTAL				**15**	**3**	**8**	**22**	

NAME OF THE SUBJECT					
Subject Code	**ADVANCED FLUID MECHANICS**	L	T	P	C
MTEPC1010		3	1	0	4

Course Outcome	
CO1	Understand the concept of fluid mechanics like statics, kinematics and dynamics, including concepts of mass, momentum and energy conservation equation.
CO2	Apply the principles of high and low Reynolds number flows to fluid flow systems.
CO3	Review the concepts of boundary layer and flow in transition.
CO4	Apply the fundamentals of one dimensional isentropic flow to variable area duct and principles of compressible flow to constant area duct subjected to friction or heat transfer

UNIT:1 (12 Hours)

Concept of continuum and definition of a fluid. Body and surface forces, stress tensor, Scalar and vector fields, Eulerian and Lagrangian description of flow. Motion of fluid element - translation, rotation and vorticity; strain rate tensor, continuity equation, stream function and velocity potential.

UNIT:2 (16 Hours)

Transport theorems, constitutive equations, derivation of Navier Stokes equations for compressible flow. Exact solutions of Navier Stokes equations : plane Poiseuille flow and Couette flow, Hagen-Poiseuille flow, flow between two concentric rotating cylinders, Stoke's first and second problem, Hiemenz flow, flow near a rotating disk.

UNIT:3 (18 Hours)

Theory of hydrodynamic lubrication. Boundary layer: derivation, exact solutions, Blasius, Falkner Skan, series solution and numerical solutions. Approximate methods. Momentum integral method. Description of turbulent flow, velocity correlations, Reynold's stresses, Prandtl's Mixing Length Theory, Karman's velocity defect law, universal velocity distribution.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books 1. Advanced Fluid Mechanics, Som and Biswas, Tata McGraw Hill.

NAME OF THE SUBJECT					
Subject Code	**HEAT TRANSFER-1**	L	T	P	C
MTEPC1020		3	1	0	4

Course Outcome

CO1	To analyze of heat conduction in 2-D fins, 2-D and 3-D conduction in solids with complex boundary conditions and heat generation
CO2	Ability to understand and solve conduction, and convection problems
CO3	Ability to analyze of transient heat conduction with complex boundary.
CO4	Ability to calculate radiant energy transfer through absorbing, emitting and scattering media

UNIT:1 (15 Hours)

Conduction; Derivation of generalized conduction equation for anisotropic inhomogeneous solids, conductive tensor, concepts of isotropic and homogeneous conductivity. ; Steady state conduction: Recapitulation of fundamentals analysis and design variable and cross section and circumferential fins. Analysis of heat conduction in 2-D fins, 2-D and 3-D conduction in solids with complex boundary conditions and heat generation.

UNIT:2 (16 Hours)

Transient conduction: Recapitulation of transient conduction in simple systems. Analysis of transient heat conduction with complex boundary. The use of green function in the solution of the equations of conduction. ; Numerical methods: Fundamentals of discrimination treatment of boundary conditions, on linearity of properties, anisotropy and complex boundaries.

UNIT:3 (14 Hours)

Radiation ; Recapitulation of fundamentals of radiative heat transfer, radiative properties of surfaces, methods of estimating configuration factors, heat exchange between diffusively emitting and diffusively reflecting surfaces. Radiant energy transfer through absorbing, emitting and scattering media. Combined conduction and radiation systems: fins, Introduction to solar radiation in earth's atmosphere.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. V.S Arpaci – Conduction Heat Transfer 2. E.M Sparrow, R.D Cess – Radiation Heat Transf
Ref. Books 1. R.Siegal and J.R Howell-Thermal radiation heat transfer. 2. Y.A.Sengel, Heat Transfer, Tata McGrawHill 3. Krith, Fundamentals of Heat Transfer 4. Ozisik, Heat Transfer, John Wiley

NAME OF THE SUBJECT					
Subject Code	**ADVANCED REFRIGERATION ENGINEERING**	L	T	P	C
MTEPC1030		3	1	0	4

Course Outcome

CO1	To analyze refrigeration cycle and to know the principles of psychometric properties and processes.
CO2	Ability to understand Thermodynamic Properties of pure and mixed refrigerants.
CO3	Ability to understand the Principle of liquefaction of gases, Dry ice manufacture.
CO4	To design and able to understand construction details of unitary refrigeration equipment.

UNIT:1 (16 Hours)

Analysis of refrigeration cycle, principles of psychrometry properties and processes, Air washer, Cooling towers, dehumidifiers, wet bulb and dew point temperatures. Multistage cycle and their optimization.

UNIT:2 (12 Hours)

Thermodynamic Properties of pure and mixed refrigerants. Eco-friendly Refrigerants, vapour absorption cycle and its components. Ejector Refrigeration System, Vortex Tubes, Principle of liquefaction of gases, Dry ice manufacture, Magnetic Refrigeration System

UNIT:3 (14 Hours)

Analysis and thermal design of Refrigeration compressor, condenser, evaporator and flow control devices; Design, Lubrication, charging and testing of refrigeration plants, defrosting capacity control, system component balancing, Design and construction details of unitary refrigeration equipment.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Refrigeration and Air Conditioning, C.P.Arora, Tata McGraw Hill
2. Refrigeration and Air Conditioning, Stoecker and Zones, McGraw Hill

Ref. Books

1. Refrigeration and Air Conditioning, Domkundwar and Arora, Dhanpat Rai and Sons
2. Refrigeration and Air Conditioning, Manohar Prasad, East West Press
3. Refrigeration and Air Conditioning, P.L.Balaney

NAME OF THE SUBJECT					
Subject Code	**INTERNAL COMBUSTION ENGINES**	L	T	P	C
MTEPE1041		3	0	0	3

Course Outcome

CO1	To illustrate design and performance of IC Engines through thermodynamic cycles, and Types of Supercharging.
CO2	To analyze of Fuels for SI and CI engines and Principle of modern carburetion
CO3	To analyze and evaluate the advance fuel injection system and Exhaust gas properties with its effects on the environment.
CO4	To design and create the advanced I C Engines.

UNIT:1 (16 Hours)

Thermodynamic Analysis of I.C.Engine Cycles. Effect of design and operating parameters on cycle efficiency. Modified fuel-air cycle considering heat losses and valve timing. Engine dynamics and torque analysis. Use of Combustion chart . Thermodynamic cycle with supercharging both S.I. and C.I. Engines. Limits of Supercharging. Methods of Supercharging and Superchargers.

UNIT:2 (12 Hours)

Fuels and combustion in S.I. engines, knocking and fuel rating. Energy balance, volumetric efficiency, measurement of indicated and brake power. Advanced theory of carburetion. Fuel Injection Systems for S.I. and C.I. Engines. Cooling of engine and governing of engine. Ignition system : conventional and electronic.

UNIT:3 (14 Hours)

Variable compression ratio engine. Theoretical analysis, methods of obtaining variable compression ratio, Wankel rotary combustion engine, Stratified charged engine, Methods of charge stratification, Dual fuel and Multifuel engines, Biofuels, Variable Valve timing engines, Exhaust emissions, its measurement and control. Fault diagnosis of S.I. Engines.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Fundamentals of I.C. Engines by H.B.Heywood, McGraw Hill

Ref. Books

1. I.C.Engine Theory and Practices, Vol.I & II C.F.Taylor, MIT Press
2. I.C.Engine, Mathur and Sharma, Dhanpat Rai and Sons
3. Fundamentals of I.C.Engine Books

NAME OF THE SUBJECT					
Subject Code	**ENERGY CONVERSION AND MANAGEMENT**	L	T	P	C
MTEPE1042		3	0	0	3
Course Outcome					
CO1	Understanding of energy conservation and identification of energy conservation opportunities in various industrial processes				
CO2	Knowledge of various tools and components for energy auditing				
CO3	Ability to evaluate the performance of industrial boilers, furnaces etc. by direct and indirect methods				
CO4	Understanding of energy management in industry, Environmental and economic evaluation of advanced pollution control technology.				

UNIT:1 (10 Hours)

Significance and Scope of Energy conservation and Management, Basic principles and total energy concept, First law optimization, availability. Exergy analysis. Second law optimization of thermal systems.

UNIT:2 (13 Hours)

Energy audits and conservation programme, elements of energy accounting. Plant energy studies : concepts, resources, procedures and implementation. Energy accounting indices, energy budget and variance analysis- statistical and engineering models. Economic aspects, payback. Waste Heat recovery; high, medium and low temperature applications, Methods of energy conservation in domestic and industrial sectors; case studies.

UNIT:3 (17 Hours)

Energy sources, Classification and characterization of fuels (fossil and bio-fuel), conversion and utilization, environmental and economic issues, optimum use of energy resources, Thermodynamic cycles, Principles of thermal energy conversion in boilers, internal combustion engines and gas turbines, cogeneration and combined cycle power generation, fuel cells and MHD technology, solar, wind and nuclear power, utilization of industrial heat, Energy management in industry, Environmental and economic evaluation advanced pollution control technology.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. *R. Gold Stick and A. Thumann, Principles of Waste Heat Recovery, PHI, 1986.*
Ref. Books 1. *D. Y. Goswami, F. Kreith, Energy Conversion- CRC Press, 2007* 2. *V. Kadambi, and M. Prasad, Introduction to energy conversion turbo machinery: Energy conversion cycle- Wiley Eastern, New Delhi, 1974*

NAME OF THE SUBJECT					
Subject Code	**GAS DYNAMICS**	L	T	P	C
MTEPE1043		3	0	0	3
Course Outcome					
CO1	To understand One dimensional Isentropic Flow and governing equation.				
CO2	To derive the conditions for the change in pressure, density and temperature for flow through a normal shock.				
CO3	To determine the strength of oblique shock waves on wedge shaped bodies and concave corners.				
CO4	To determine the change in flow conditions through a Prandtl-Meyer expansion wave.				

UNIT:1 (14 Hours)

Fundamental Aspects of Gas Dynamics: Introduction, Isentropic flow in a stream tube, speed of sound, Mach waves; One dimensional Isentropic Flow: Governing equations, stagnation conditions, critical conditions, maximum discharge velocity, isentropic relations ; Normal Shock Waves: Shock waves, stationary normal shock waves, normal shock wave relations in terms of Mach number

UNIT:2 (12 Hours)

Oblique Shock Waves: Oblique shock wave relations, reflection of oblique shock waves, interaction of oblique shock waves, conical shock waves; Expansion Waves: Prandtl-Meyer flow, reflection and interaction of expansion waves, flow over bodies involving shock and expansion waves ; Variable Area Flow: Equations for variable area flow, operating characteristics of nozzles, convergent-divergent supersonic diffusers ; Adaiabatic Flow in a Duct with Friction: Flow in a constant area duct, friction factor variations, the Fanno line.

UNIT:3 (14 Hours)

Flow with Heat addition or removal: One-dimensional flow in a constant area duct neglecting viscosity, variable area flow with heat addition, one-dimensional constant area flow with both heat exchanger and friction ; Generalized Quasi-One-Dimensional Flow: Governing equations and influence coefficients, solution procedure for generalized flow with and without sonic point ; Two-Dimensional Compressible Flow: Governing equations, vorticity considerations, the velocity potential, linearized solutions, linearized subsonic flow, linearized supersonic flow, method of characteristics.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. L. D. Landau and E. M. Lifshitz, Fluid Mechanics. 2nd ed., Butterworth-Heinemann, 1995.
2. H. W. Liepmann, and A. Roshko, Elements of Gas Dynamics, Dover Pub, 2001.

Ref. Books

1. P. H. Oosthuizen and W. E. Carscallen. Compressible Fluid Flow. NY, McGraw-Hill, 1997.
2. M. A. Saad, Compressible Fluid Flow. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 1993.
3. F. M. White, Viscous Fluid Flow. 2nd ed. New York: McGraw-Hill, 1991.
4. A.H. Shapiro, Compressible Fluid Flow 1 and 2. Hoboken NJ: John Wiley.

NAME OF THE SUBJECT					
Subject Code	**HYDEL POWER AND WIND ENERGY**	L	T	P	C
MTEPE1044		3	0	0	3

Course Outcome

CO1	To understand Power house structures and Layout
CO2	To analyze the firm capacity, reservoir capacity and capacity factor
CO3	Able to understand wind turbine aerodynamics and momentum theories
CO4	To understand the Wind Energy Conversion System (WECS) setting, rotor selection, Annual Energy Output (AEO).

UNIT:1 (14 Hours)

Elements of hydropower scheme, hydropower development in India. Power house structures and Layout. Hydropower plants classification: Surface and underground power stations, Low-medium-high head plants-layout and components, pumped storage plants. Load and power studies: load curve, load factor, load duration curve, firm capacity, reservoir capacity, capacity factor.

UNIT:2 (12 Hours)

Hydraulic turbines and types and classification, constructional features, selection, characteristic curves, governing of turbine, drafts tubes-types, hydraulic principles. Gates and valves types. Penstock and surge tanks. Wind machine types, classification, parameters. Wind measurements, data presentation, power in the wind. Wind turbine aerodynamics, momentum theories, basic aerodynamics, airfoils and their characteristics

UNIT:3 (14 Hours)

Horizontal Axis Wind Turbine (HAWT) - Blade Element Theory, wake analysis, Vertical Axis Wind Turbine (VAWT) aerodynamics. HAWT rotor design considerations, number of blades, blade profile, 2/3 blades and teetering, coning, power regulation, yaw system, tower.
Wind turbine loads, aerodynamic loads in steady operation, wind turbulence, static - dynamic - fatigue analysis, yawed operation and tower shadow, WECS control system, requirements and strategies. Wind Energy Conversion System (WECS) siting, rotor selection, Annual Energy Output (AEO). Synchronous and asynchronous generators and loads, integration of wind energy converters to electrical networks, inverters. Testing of WECS.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Water Power Engineering: M.M.Desmukh, Dhanpat rai and Sons
2. Wind Energy Conversion Systems, Freris L.L., Prentice Hall 1990.

Ref. Books

1. Water power Development: Mosonyi
2. Hydroelectric hand book: Creagar, W.P. and Justin, J.D., John Wiley & Sons,New York.
3. Davis' Handbook of applied hydraulics : Zipparro, V. J. and Hasen H., Mc-GrawHill, Inc.,
4. Hydropower structures : R.S.Varshiray, Nem Chand and Bros. Roorkee.

NAME OF THE SUBJECT					
Subject Code	**SOLAR ENERGY TECHNOLOGY**	L	T	P	C
MTEPE 1051		3	0	0	3

Course Outcome	
CO1	To recall various alternate energy sources and its uses.
CO2	To design the various Components of solar energy systems and analysis the collector performance.
CO3	To understand Solar thermal systems applications to power generation, heating and cooling
CO4	To analyze the economics of solar and wind energy systems.

UNIT:1 (14 Hours)

Current alternate energy sources-thermodynamic view point and conversion methods. Components of solar energy systems, collector performance. Radiation and meteorological data processing, long term conversion factors. System configurations and system performance prediction.

UNIT:2 (12 Hours)

Simulations, design methods. System design and optimizations. Solar thermal systems applications to power generation, heating and cooling.

UNIT:3 (14 Hours)

Solar passive devices solar stills, ponds, greenhouse, dryers. Trombe wall, overhangs and winged walls. Wind energy conversion systems. Economics of solar and wind energy systems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. S. P. Sukhatme, Solar Energy - Principles of thermal collection and storage, second edition, Tata McGraw-Hill, New Delhi, 1996
2. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, second edition, John Wiley, New York, 1991

Ref. Books

1. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000
2. D. D. Hall and R. P. Grover, Biomass Regenerable Energy, John Wiley, New York, 1987.
3. J. Twidell and T. Weir, Renewable Energy Resources, E & F N Spon Ltd, London, 1986.

NAME OF THE SUBJECT					
Subject Code	**THERMAL AND NUCLEAR POWER PLANT**	L	T	P	C
MTEPE 1052		3	0	0	3

Course Outcome	
CO1	To understand various the energy resources and energy conversion methods available for the production of electric power.
CO2	Able to understand coal handing installation system and methods for controlling the combustion.
CO3	To understand various boiler accessories and mounting used in stem power plant.
CO4	To know the basic concepts of reactor physics, radioactivity. Neutron Scattering.

UNIT:1 (14 Hours)

Energy scenario. Overview of steam power plant. Analysis of steam cycles. Feedwater heaters. Deaerator and drain cooler. Optimization of cycle parameters, reheat and regeneration. Analysis of multi-fluid coupled cycles. Cogeneration of power and process heat. Combined cycle power generation. Fuels. Combustion mechanisms. Draft systems. Combustion control. Furnaces for burning coal in fluidized beds and in pulverized form. Coal handling installation.

UNIT:2 (12 Hours)

Different types of boilers and their specific uses. Boiler mountings and accessories. Feedwater treatment. Boiler maintenance. Circulation theory. Downcomers and risers. Drum and its internals. Economiser. Convective and radiant super heaters. Superheat temperature control. Recuperative and regenerative air preheaters. Dust and ash removal systems. Environmental aspects of power generation

UNIT:3 (14 Hours)

Basic concepts of reactor physics, radioactivity. Neutron Scattering. Thermal and fast reactors. Nuclear cross-sections. Neutron flux and reaction rates. Moderator criteria. Reactor core design. Conversion and breeding. Types of reactors. Characteristics of boiling water, pressurized water, pressurized heavy water, gas cooled and liquid metal cooled reactors. Future trends in reactor design and operation. Thermal-hydraulics of reactors. Heavy water management. Containment system for nuclear reactor. Reactor safety radiation shields. Waste management. Indian nuclear power programme.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. M.M.El. Wakil., _Nuclear Power Engineering', McGraw Hill Book Company, New York, 1987.

2. S. Glasstone and A. Setonske., ‗Nuclear Reactors, Engineering', 3rd Ed., CBS Publishers and Distributors, 1992.

Ref. Books

1. Loftness, Nuclear Power Plants', D. Van Nostrand Company Inc, Princeton, 1964.
2. S. Sarg et al., Physics of Nuclear Reactors', Tata McGraw Hill Publishing Company Ltd., 1985.
3. T. J. Connoly., Fundamentals of Nuclear Energy', John Wiley, 1978.

NAME OF THE SUBJECT					
Subject Code	**RENEWABLE ENERGY SYSTEM**	L	T	P	C
MTEPE 1053		3	0	0	3

Course Outcome

CO1	Enable students to understand various renewable energy technologies and systems
CO2	To impart the knowledge of Storage technologies form the autonomous renewable energy sources
CO3	Equip the students with knowledge and understanding of various possible mechanisms about renewable energy projects
CO4	Create awareness among students about Non-Conventional sources of energy technologies

UNIT:1 (14 Hours)

Energy scenario and renewable energy sources : global and Indian situation. Potential of non-conventional energy sources, economics. Solar Radiation: Solar thermal process, heat transfer devices, solar radiation measurement, estimation of average solar radiation. Solar energy storage: stratified storage, well mixed storage, comparison.

UNIT:2 (12 Hours)

Hot water system, practical consideration, solar ponds, Non-convective solar pond, extraction of thermal energy and application of solar ponds. Wind energy: The nature of wind. Wind energy resources and modeling. Geothermal energy: Origin and types of geothermal energy and utilization.

UNIT:3 (14 Hours)

OTEC: Ocean temperature differences. OTEC systems. Recent OTEC developments. Wave energy: Fundamentals. Availability Wave-energy conversion systems. Tidal energy: Fundamentals. Availability Tidal-energy conversion systems. ; Energy from biomass: Photosynthesis; Biomass resource; Utilisation of biomass.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. S.P.Sukhatme, Solar Energy Principle of Thermal Collection and Storage', Tata McGraw Hill, 1990.
2. G.L. Johnson, Wind energy systems, Prentice Hall Inc. New Jersey.
3. J.M.Kriender, Principles of Solar Engineering', McGraw Hill, 1987.

Ref. Books

1. V.S. Mangal, Solar Engineering', Tata McGraw Hill, 1992.
2. N.K.Bansal, Renewable Energy Source and Conversion Technology', Tata

McGraw Hill, 1989.
3. P.J. Lunde., Solar Thermal Engineering', John Willey & Sons, New York, 1988.
4. J.A. Duffie, and W.A. Beckman, Solar Engineering

NAME OF THE SUBJECT					
Subject Code	**DESIGN OF THERMAL SYSTEM**	L	T	P	C
MTEPE 1054		3	0	0	3

Course Outcome

CO1	To Integrate thermal component models and simulate a thermal system.
CO2	To Perform an economic analysis of a thermal system.
CO3	To apply optimization procedures and design optimized thermal systems
CO4	Understand the ethical issues associated with decision making

UNIT:1 (14 Hours)

Modeling of Thermal Systems: types of models, mathematical modeling, curve fitting, linear algebraic systems, numerical model for a system, system simulation, methods for numerical simulation

UNIT:2 (12 Hours)

Acceptable Design of a Thermal System: initial design, design strategies, design of systems from different application areas, additional considerations for large practical systems; Economic Considerations: calculation of interest, worth of money as a function of time, series of payments, raising capital, taxes, economic factor in design, application to thermal systems

UNIT:3 (14 Hours)

Problem Formulation for Optimization: optimization methods, optimization of thermal systems, practical aspects in optimal design, Lagrange multipliers, optimization of constrained and unconstrained problems, applicability to thermal systems; search methods: single-variable problem, multivariable constrained optimization, examples of thermal systems; geometric, linear, and dynamic programming and other methods for optimization, knowledge-based design and additional considerations, professional ethics.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. W.F. Stoecker, Design of Thermal Systems - McGraw-Hill, 1971

Ref. Books

1. Y. Jaluria, Design and Optimization of Thermal Systems –CRC Press, 2007.
2. Bejan, G. Tsatsaronis, M.J. Moran, Thermal Design and Optimization - Wiley, 1996.
3. R. F. Boehm, Developments in the Design of Thermal Systems - Cambridge

University Press, 1997.
4. N.V. Suryanarayana, Design & Simulation of Thermal Systems - MGH, 2002.

NAME OF THE SUBJECT					
Subject Code	**ENGINEERING SOFTWARE LABORATORY**	L	T	P	C
MTEES1160		0	0	8	4
Course Outcome					
CO1	Model laminar and turbulent flow using conservation laws.				
CO2	Perform discretization of diffusion problems using finite difference and finite volume methods.				
CO3	Model one dimensional convection– diffusion problems.				
CO4	Solve fluid flow and heat transfer problems using SIMPLE and PISO algorithms.				

ANY FIVE EXPERIMENTS

1. Survey on CFD softwares and their comparison
2. Mesh generation technique by applying technical computing languages
3. Numerical modelling of steady-state conductive heat transfer for simple and complex boundary conditions,(for all co-ordinate systems)
4. Numerical modelling of transient conductive heat transfer for simple and complex boundary conditions in homogeneous/heterogeneous medium.
5. Numerical modelling of Radiative heat transfer in a participating medium, Overview of different radius models.
6. Application of Fluent/phoenix/NISA for simulation of heat and fluid flow.
7. Development of non-dimensional mass/energy/momentum equations for laminar/turbulent flow.

II SEMESTER								
SL.No	Course Category	Course Code	Course Title	L	T	P	C	
THEORY								
1.	PC	MTEPC2010	ADVANCED ENGINEERING THERMODYNAMICS	3	1	0	4	
		MTEPC2020	ADVANCED HEAT TRANSFER-II	3	1	0	4	
2.	PE	MTEPE2031	COMPUTATIONAL FLUID DYNAMICS	3	0	0	3	
		MTEPE2032	HEAT EXCHANGER ANALYSIS AND DESIGN	3	0	0	3	
		MTEPE2033	COMPUTATIONAL METHODS IN THERMAL ENGINEERING	3	0	0	3	
		MTEPE2034	EXPERIMENTAL METHODS IN THERMAL ENGINEERING	3	0	0	3	
3.	PE	MTEPE2041	THEORY OF COMBUSTION AND EMISSION	3	0	0	3	
		MTEPE2042	AIR CONDITIONING AND VENTILATION SYSTEMS	3	0	0	3	
		MTEPE2043	GAS TURBINE AND JET PROPULSION	3	0	0	3	
		MTEPE2044	BOILING,CONDENSATION AND TWO-PHASE FLOW	3	0	0	3	
4.	PE	MTEPE2051	CRYOGENIC TECHNOLOGY	3	0	0	3	
		MTEPE2052	AIRCRAFT AND ROCKET PROPULSION	3	0		3	
		MTEPE2053	POWER PLANT AND PRACTICE	3	0	0	3	
		MTEPE2054	FINITE ELEMENT METHODS IN THERMAL ENGINEERING	3	0	0	3	
PRACTICAL								
1	ES	MTEES2160	ADVANCED THERMAL ENGG AND MEASUREMENT LABORATORY	0	0	8	4	
2	ES	MTEES2170	SEMINAR I	0	0	4	2	
TOTAL				**15**	**2**	**12**	**23**	

NAME OF THE SUBJECT					
Subject Code	**ADVANCED ENGINEERING THERMODYNAMICS**	L	T	P	C
MTEPC 2010		3	1	0	4

Course Outcome

CO1	Understand Maxwell's and thermodynamics relations of gas mixtures
CO2	Identify the models to estimate the properties of real gas
CO3	Analyze reactive and non reactive gas mixtures using the concept of statistical thermodynamics and kinetics theory of gases
CO4	Analyze chemical reaction and gas mixtures.

UNIT:1 (12 Hours)

Review of Basics: First law and Second law analysis – concept of entropy – principle of increase of entropy – entropy generation – Availability – concept of energy – energy analysis of combustion processes. Helm Holtz function – Gibb's function – On Sagar reciprocity relation.

UNIT:2 (14 Hours)

Thermodynamic relations, Maxwell's relations, T-ds equations – specific heat relations – energy equation – Joule Thomson effect – Clausius Clapery on Equation. Criteria for Equilibrium – Gibb's phase rule – Conditions for stability. Compressibility factor, fugacity and activity, computation from the generalized charts, dependence of fugacity and activity on pressure and temperature, chemical – equilibrium. Phase rule – ideal and real solution of gases, liquids, equilibrium system.

UNIT:3 (16 Hours)

Statistical Thermodynamics: Thermodynamics probability, Maxwell statistics, Fermi Dirac and Bose – Einstein statistics, Entropy and probability, Degeneracy of energy levels, Partition functions. Kinetic Theory of Gases: Perfect gas model, Distribution of translational velocities distribution function, molecular collisions and mean free path, equipartition of energy.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. A.S. Michael, '*Thermodynamic for Engineers*', Prentice Hall, 1972.
2. P.K. Nag., '*Engineering Thermodynamics*', II Ed., McGraw Hill, 1995.

Ref. Books

1. . G.J. Van Wylen & R.E. Sonntag., '*Fundamentals of Classical Thermodynamics*', Willy Eastern Ltd. 1989 (Unit I, II & III)
2. J.P. Holman., '*Thermodynamics*', 4th Ed., McGraw Hill, 1988.

3. J. Hsieg, '*Principles of Thermodynamics*', McGraw Hill, 1978.
4. Lee and Sears, '*Statistical Thermodynamics*', Addition Wesley, 1976.
5. V. Nastrand, S. Glasstne., _*Thermodynamics for Chemists*', 1974.

NAME OF THE SUBJECT					
Subject Code	**ADVANCED HEAT TRANSFER-II**	L	T	P	C
MTEPC 2020		3	1	0	4

Course Outcome

CO1	Ability to analyze the Practical correlations on flow over surfaces.
CO2	Able to Understand the concept of combined forced and free convection, combined convection and radiation in flows.
CO3	Ability to understand the various types of heat exchangers and their uses
CO4	Ability to design and analyze the performance of heat exchangers and evaporators

UNIT:1 (10 Hours)

Convection: Energy equation – thermal boundary layer. Forced convection – Practical correlations –flow over surfaces – internal flow.

UNIT:2 (14 Hours)

Natural convection, combined forced and free convection combined convection and radiation in flows. ; Boiling and Condensation: Boiling – Pool and flow boiling, correlations. Condensation – modes and mechanisms – correlations and problems.

UNIT:3 (16 Hours)

Heat Exchangers: Heat Exchanger and Mass Transfer -Heat exchanger: types – LMTD method and the effectiveness – NTU method. Mass Transfer: types – Fick's law of diffusion – mass diffusion equation, Equimolar counter diffusion – convective mass transfer. Evaporation of water into air.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. J.P. Holman., '*Heat and Mass Transfer*', Tata McGraw Hill, 8th Ed., 1989.
2. D.D. Kern, '*Extended Surface Heat Transfer*', New Age International Ltd., 1985.

Ref. Books

1. F.P. Incropera and D. P. Dewit, _*Fundamentals of Heat and Mass Transfer*', 4th Ed., John
2. Wiley & Sons, 1998.
3. C.P. Kothandaraman., _*Fundamentals of Heat and Mass Transfer*', 2nd Ed., New Age International, 1997.
4. E.R.D Eckert and R.M. Drake, _*Analysis of Heat and Mass Transfer*', McGraw Hill,

1980.
5. Kays, W.M. and Crawford W., _*Convective Heat and Mass Transfer*', McGraw Hill Inc., 1993.
6. Burmister L.C., '*Convective Heat Transfer*', John Willey and Sons, 1983.

<table>
<tr><th colspan="6">NAME OF THE SUBJECT</th></tr>
<tr><td>Subject Code</td><td>COMPUTATIONAL FLUID DYNAMICS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>MTEPE 2031</td><td></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">Course Outcome</td></tr>
<tr><td>CO1</td><td colspan="5">Ability to Understand the solution of aerodynamic flows. Appraise & compare current CFD software. Simplify flow problems and solve them exactly.</td></tr>
<tr><td>CO2</td><td colspan="5">Able to analyze the concept of discrete representation of flow and heat transfer domain</td></tr>
<tr><td>CO3</td><td colspan="5">Ability to solve the Error analyze in discretization using FVM/FDM</td></tr>
<tr><td>CO4</td><td colspan="5">To Understand the both flow physics and mathematical properties of governing Navier-Stokes equations and define proper boundary conditions for solution</td></tr>
<tr><td colspan="6">UNIT:1 (12 Hours)
Introduction: Basic tools of CFD, Numerical Vs experimental tools. ; Mathematical Behavior of PDEs: Parabolic, Hyperbolic and Elliptic PDEs. ; Methodology of CFDHT: Discrete representation of flow and heat transfer domain: Grid generation, Governing equations and boundary conditions based on FVM/FDM, Solution of resulting set of linear algebraic equations.</td></tr>
<tr><td colspan="6">UNIT:2 (14 Hours)
Graphical representation and analysis of qualitative results, Error analysis in discretization using FVM/FDM. ; Solution of 1-D/2-D steady/unsteady: Diffusion problems, Convection problems, Convection-diffusion problems, source term linearization.</td></tr>
<tr><td colspan="6">UNIT:3 (16 Hours)
Explicit and Implicit Approach: Explicit and implicit formulation of unsteady problems, Stability analysis. ; Solution of Navier-Stokes Equations for Incompressible Flows: Staggered and collocated grid system, SIMPLE and SIMPLER algorithms. ; Special Topics in CFDHT: Numerical Methodology for Complex Geometry, Multi-block structured grid system, Solution of phase change Problems.</td></tr>
<tr><td colspan="6">Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.</td></tr>
<tr><td colspan="6">Text Books
1. S.V. Patankar, Numerical Heat Transfer and Fluid Flow, Taylor and Francis, ISBN-10: 0891165223.</td></tr>
<tr><td colspan="6">Ref. Books
1. H. K. Versteeg and W. Malalasekra, Introduction to Computational Fluid Dynamics: The Finite Volume Method, Prentice Hall (2nd Edition), ISBN-10:</td></tr>
</table>

0131274988.
2. Jr. D. A. Anderson, *Computational Fluid Mechanics and Heat Transfer* by McGraw-Hill Education
3. M. N. Ozisik, *Finite Difference Method,* CRC (1st Edition).

Subject Code	**HEAT EXCHANGER ANALYSIS AND DESIGN**	L	T	P	C
MTEPE 2032		3	0	0	3

Course Outcome

CO1	To understand the method of LMTD for heat exchanger analysis for parallel, counter, multi-pass and cross flow heat exchanger.
CO2	To analyze the Heat transfer enhancement, plate fin heat exchanger, tube fin heat exchanger, heat transfer and pressure drop.
CO3	To understand Temperature and flow Distribution and its implications on heat exchangers.
CO4	To analyze types of failures on design aspects of heat exchanger.

UNIT:1 (12 Hours)

Constructional Details: Types, Fluid flow arrangements, parallel, counter and cross flow, shell and tube heat exchanger, Regenerators and recuperator. Condensers – Industrial applications. ; Heat Transfer: Modes of Heat Transfer, Overall heat transfer coefficient, Thermal resistance, Efficiency.

UNIT:2 (14 Hours)

Temperature Distribution and its implications, LMTD, effectiveness ; Flow Distribution: Effect of Turbulence, Friction Factor, Pressure Loss, Orifice, Flow nozzle, Diffusers, Bends, Baffles, Effect of Channei Divergence, Manifolds. ; Stress in tubes, Headers sets .

UNIT:3 (16 Hours)

Pressure vessels: Differential Thermal Expansion, Thermal stresses, Shear stresses, Thermal sleeves, Vibration, Noise, types of failures. ; Design Aspects: Heat transfer and pressure loss flow configuration effect of baffles. Effect of deviations from ideality. Design of typical liquid-liquid, gas-gas-liquid heat exchangers. Design of cooling towers.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. W.M. Kays and A.L. London., _*Compact Heat Exchangers*', 3rd Ed., TMH,1984.
2. A.P. Frass and M.N.Ozisik, *Heat Exchanger Design*',John Wiley & Sons Inc, 1965.
3. G.Wlker, _*Industrial Heat Exchangers*', A basic guide, TMH V Book Co., 1980.

Ref. Books

1. '*Standards of the Turbular Exchanger Manufacturer Association*', 6th Ed., Tubular Exchanger Manufacturers Association, New York, 1978.
2. D. Q Kern, _*Process Heat Transfer*', McGraw Hill Book Co., 1984.
3. E.A.D. Saunders., _*Heat Exchangers*', Longman Scientific and Technical, New York, 1988.

NAME OF THE SUBJECT					
Subject Code	**COMPUTATIONAL METHODS IN THERMAL ENGINEERING**	L	T	P	C
MTEPE 2033		3	0	0	3
Pre -Requisite: **Engineering Thermodynamics, Heat transfer Fluid mechanics, Mathematics**					
Course Outcome					
CO1	Understand the stepwise procedure to completely solve a fluid dynamics problem using computational methods.				
CO2	Derive the governing equations and understand the behavior of the equations				
CO3	Analyze the consistency, stability and convergence of various discretisation schemes for parabolic, elliptic and hyperbolic partial differential equations				
CO4	Analyze variations of SIMPLE schemes for incompressible flows and Variations of Flux Splitting algorithms for compressible flows.				

UNIT:1 (12 Hours)

Introduction: Concepts of consistency, stability, and convergence of numerical schemes. Various finite difference and finite element methods and their applications to fundamental partial differential equations in engineering and applied sciences. Case studies selected from fluid mechanics and heat transfer.

UNIT:2 (12 Hours)

Finite Difference Method: Classification, Initial and Boundary conditions, Forward, Backward difference, Uniform and non-uniform Grids, Grid Independence Test. Basic finite difference schemes. Boundary treatments. Fourth order RK methods and Predictor-corrector methods and Nachsheim-Swigert iteration with applications to flow and heat transfer.

UNIT:3 (16 Hours)

Parabolic and hyperbolic problems: Model problems and stability estimates. Examples of the methods of lines. The Lax-Richtmyer equivalence theorem. Stability analysis. Discrete Fourier series. Von- Neumann stability analysis. Consistency, convergence and error estimates. Keller Box and Smith's method with applications to thermal boundary layers. ; Convection dominated problems: The failure of standard discretization, Upwinding and Higher order methods.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. K.Muralidhar and T.Sundararajan, "*Computational Fluid Flow and Heat Transfer*", Narosa Publishing House ,New Delhi1995.
2. P.S., Ghoshdasdidar, "*Computer Simulation of flow and heat transfer*" TMH Ltd., 1998.

Ref. Books

1. S.V. Patankar, "*Numerical heat transfer fluid flow*", Hemisphere Publishing Co, 1980.
2. D.A. Anderson, I.I. Tannehill, and R.H. Pletcher, *Computational Fluid Mechanics and Heat Transfer*, Hemishphere Publishing Corporation, New York, USA, 1984.
3. C.A.J. Fletcher, ,"*Computational Techniques for Fluid Dynamics*
4. *Fundamental and General Techniques*, Springer-Verlag,1987.

NAME OF THE SUBJECT					
Subject Code	**EXPERIMENTAL METHODS IN THERMAL ENGINEERING**	L	T	P	C
MTEPE 2034		3	0	0	3
Course Outcome					
CO1	To identify the suitable instrument for measuring transport parameters and estimate error				
CO2	To detect suitable range of pressure gauge and compute its dynamic response				
CO3	To distinguish different flow visualization methods and temperature measurements				
CO4	To determine thermal conductivity in solids, liquids and gases and radiation measurements				

UNIT:1 (10 Hours)

Probability and Statistics: Fundamental definition, Conditional probability and Bayes theorem, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions, Regression analysis, Elements of sampling theory.

UNIT:2 (16 Hours)

Introduction to measurement: Importance of measurement and experimentation, calibration, uncertainty analysis, error propagation, Gaussian or Normal distribution, confidence level, regression analysis, correlation coefficient, Chi-Square test, zeroth-, first- and second-order systems. Pressure Measurement: Manometers, bourdon tube pressure gage, diaphragm gage, bellow gage, McLeod gage, Pirani gage and ionization gage. Flow measurement: Positive displacement flow meters, venture, orifice, impact tube, flow nozzle, sonic nozzle, rotameter, pitot static tube, hot-wire anemometer, laser Doppler anemometer, flow visualization techniques – shadowgraph, Schlieren and interferometer

UNIT:3 (16 Hours)

Temperature measurement: Hg-in-glass thermometer, RTD, thermistor, thermocouple, thermopile, liquid-crystal thermography, optical pyrometer. Thermal conductivity measurement: Guarded hot plate apparatus, heat flux meter. Data acquisition and processing: Signal conditioning, data transmission, storage, A to D and D to A conversion.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. J. P. Holman, Experimental Methods for Engineers

Ref. Books 1. T.G. Beckwith, J.H. Lienhard V,R. D. Marngoni, Mechanical Measurements.¬ E.O. Doebelin, Measurement systems, Application and Design

NAME OF THE SUBJECT					
Subject Code	**THEORY OF COMBUSTION AND EMISSION**	L	T	P	C
MTEPE 2041		3	0	0	3

Course Outcome

CO1	To understand various concept of refrigeration and power cycles
CO2	To understand various combustion mechanism in SI and CI engines, and to analysis ignition and burning rate.
CO3	To understand fundamentals of bubbling bed, types of gas and liquid burners, gas turbine combustion systems and various combustion modeling.
CO4	To design of combustion systems for boilers, furnaces, gas turbines and internal combustion engines and to determine combustion chamber performance

UNIT:1 (10 Hours)

CYCLE ANALYSIS; Gas, steam and combined power cycles, refrigeration and air conditioning cycles, second law analysis.

UNIT:2 (14 Hours)

COMBUSTION THEORY ; Fuels and types, combustion process, combustion mechanism, adiabatic flame temperature, flame propagation, stability, kinetics, combustion aerodynamics, gaseous detonations, flame ignition and extinction and condensed phase combustion, combustion in SI and CI engines, ignition and burning rate analysis.

UNIT:3 (16 Hours)

COMBUSTION SYSTEMS ; Solid burning equipments, stokers, pulverized coal burning systems, cyclone combustors, emissions, types of fluidized beds, fluidized bed combustion, fundamentals bubbling bed, gas and liquid burners types, gas turbine combustion systems, combustion modeling.

DESIGN OF COMBUSTION SYSTEMS ; Design of combustion systems for boilers, furnaces, gas turbines and internal combustion engines, combustion chamber performance.

PROPELLANT SYSTEMS; Types, theory of combustion, energy balance calculations

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. C.R. Ferguson and A.T. Kirk Patrick, ―*Internal Combustion Engines*_, John Wiley & Sons. Inc. 2001.

Ref. Books

1. Stephen R Turns, ―*Introduction to Combustion: Concepts and Applications*_, McGraw Hill, 2000

2. G.L. Borman and K.N. Ragland, ―*Combustion Engineering*‖, McGraw Hill, 1998.
3. D.Winterbone, ―Advanced Thermodynamics for Engineers‖, Elsevier, 1996

Subject Code	**AIR CONDITIONING AND VENTILATION SYSTEMS**	L	T	P	C
MTEPE 2042		3	0	0	3
CO1	To design human comfort air conditioning system related to cooling load estimation				
CO2	To identify the determining factors for proper choice and design of technical systems for heating, cooling and ventilation.				
CO3	To determine design data for individual components and estimate the need of energy and power for alternative technical systems.				
CO4	Able to estimate heating, cooling, humidifying and dehumidifying requirements for air conditioning components and systems using psychometric chart.				

UNIT:1 (10 Hours)

Psychrometry: simple psychometrics processes, use of psychometrics chart. ; Summer Air –conditioning, Winter Air-Conditioning, Comfort and industrial air conditioning ; Design Conditions, ventilation loads, Comfort air-Conditioning, Physiological factors..

UNIT:2 (14 Hours)

Comfort index. Load Estimation, Applied Psychrometrics Air conditioning systems: Spray systems, chilled water and DE Coils, absorption and adsorption systems. Humidifiers. ; Principles of ventilation. Air filtration, Air conveying Fans, ducts and air diffusion equipment

UNIT:3 (16 Hours)

Estimation of air conditioning load, determination of supply state. Design and constructional details of Unitary air conditioning equipment. ; Noise level and acoustic control. Automatic controls in air conditioning.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. W.F. Stoecker, and J.W. Jones, *Refrigeration and Air Conditioning*, 2nd Edition, Tata McGraw Hill, New Delhi 1982.

Ref. Books

1. *ASHRAE Handbook- Fundamentals, American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc*., Atlanta, USA, 1997.
2. W.R Haines and C.L Wilson, *HVAC Systems Design Handbook*, McGraw Hill, 2nd Ed., New Delhi, 1994.
3. R.C Legg, *Air Conditioning Systems - Design, Commissioning and maintenance*, Batsford Ltd, London 1991.

<table>
<tr><td colspan="6">NAME OF THE SUBJECT</td></tr>
<tr><td>Subject Code</td><td>GAS TURBINE AND JET PROPULSION</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>MTEPE 2043</td><td></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6">Course Outcome</td></tr>
<tr><td>CO1</td><td colspan="5">Understand the working principle of Brayton cycle with intercooler, reheat, regeneration.</td></tr>
<tr><td>CO2</td><td colspan="5">Apply the principle of compressibility effect and know the normal shock wave, oblique shock wave in supersonic compression and expansion.</td></tr>
<tr><td>CO3</td><td colspan="5">Calculate work done by turbine, pressure rise and performance characteristics curve in combustion process.</td></tr>
<tr><td>CO4</td><td colspan="5">Design of combustion chamber, axial flow turbine and centrifugal flow turbine.</td></tr>
<tr><td colspan="6">UNIT:1 (14 Hours)
Introduction, application, shaft power gas dynamics – Compressibility effect, steady one dimensional compressible flow of a perfect gas in a duct, isentropic flow in a constant area duct with friction, normal shock waves, oblique shock wave, isentropic two dimensional, supersonic expansion and compression. ; Centrifugal fans Blowers and Compressors: Principle of operations, work done and pressure rise, slip factor, diffusers, compressibility effects, non dimensional qualities for plotting compressor characteristics.</td></tr>
<tr><td colspan="6">UNIT:2 (14 Hours)
Bray ton cycle, regeneration and reheating cycle analysis ; Axial flow fans and compressors: Elementary theory, degree of reaction, three dimensional flow, simple design methods, blade design, calculation of stage performance, overall performance, and compressibility effects. Performance characteristics. ; Combustion system: Form of combustion, important factors affecting combustion chamber design, combustion processes, combustion chamber performance, practical problem. ; Axial flow turbines: elementary theory, vortex theory, choice of blade profile, pitch and chord , estimation of stage performance, he cooled turbine.</td></tr>
<tr><td colspan="6">UNIT:3 (16 Hours)
Prediction of performance of simple gas turbines: component characteristic, off design shaft gas turbine, equilibrium running gas generators, off design on free turbine and jet engine, methods of displacing the equilibrium, running line, incorporation of variable pressure losses, methods of improving part load performance, matching procedure for twin spool engines, behavior of gas turbine .Gas turbine rotors and stresses.</td></tr>
<tr><td colspan="6">Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.</td></tr>
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Text Books 1. J.E Lee, *Theory and design of stream and gas turbine*.
Ref. Books 1. Cohen & Rogers, *Gas Turbines*

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NAME OF THE SUBJECT					
Subject Code	**BOILING, CONDENSATION AND TWO-PHASE FLOW**	L	T	P	C
MTEPE 2044		3	0	0	3

Course Outcome	
CO1	Identify the mechanisms of heat transfer during phase change processes
CO2	Design heat transfer equipment in which phase change (boiling or condensation) takes place
CO3	To understand the two Fluid-Population Balance techniques.
CO4	Able to understand the laminar film condensation on a vertical plate

UNIT:1 (10 Hours)

Introduction, Flow Regimes, Homogeneous Flow, Drift Flux, Separated Flow, Bubbly, Slug, Annular and Stratified Flow, Measurement of Void Fraction. Signal Analysis,

UNIT:2 (14 Hours)

Two Fluid-Population Balance technique, Volume of Fluid Method, Lattice Boltzmann Model, Smoothed Particle Hydrodynamics. Molecular Dynamics, Boiling, Condensation, Solid-Liquid Flow, Gas-Solid-Flow.

UNIT:3 (16 Hours)

Condensation and Boiling

Dimensionless parameters, boiling modes, correlations, Forced convection boiling, laminar film condensation on a vertical plate, turbulent film condensation

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Ghiaasiaan,S. M., Two-Phase flow,Boiling, and Condensation, Cambridge University Press
2. 2.Brennen, C.E., Fundamentals of Multiphase Flow, Cambridge University Press

Ref. Books

1. Collier, J. G. and Thome, J. R., Convective Boiling and Condensation, 3rd ed., Oxford University Press
2. Wallis, G.B., One Dimensional Two Phase Flow, McGraw Hill Higher Education

NAME OF THE SUBJECT					
Subject Code	**CRYOGENIC TECHNOLOGY**	L	T	P	C
MTEPE 2051		3	0	0	3

Course Outcome

CO1	To relate the physics properties of materials at cryogenics parameters.
CO2	To Apply cryogenic treatments and cryogenic insulations in the technical application
CO3	To Design and analyze the Characterization of cryogenically processed materials
CO4	To evaluate & prepare Cryogenic processing of materials for different applications in the real world with a consideration for environmental hazards

UNIT:1 (10 Hours)

Introduction: Cryogenic heat transfer applications, Material Properties at cryogenic temperatures, specific heats and thermal conductivity of solid, liquid and gases, Cryogenic insulations, gas-filled and evacuated powders and fibrous materials, microsphere and multi-layer insulations.

UNIT:2 (14 Hours)

Conduction: One-dimensional steady-state and transient conduction, conduction in composite materials, thermal contact resistance, cool-down in coated surfaces and fluid-storage vessels. ; Convection: Free and forced convection over external surfaces and tubes, Heat transfer in nearcritical region and its correlations, Kapitza conductance. ; Two-Phase Heat Transfer: Flow regimes, pressure drop, Lockhart-Martinelli correlation, pool boiling, forced convection boiling

UNIT:3 (16 Hours)

Radiation: Radiation from LNG fires, free-molecular flow and heat transfer, free-molecular heat transfer in enclosures. ; Heat Exchanger: Cryogenic heat exchanger types, NTU-effectiveness design method, Giauque- Hampson design, Plate-fin and perforated-plate heat exchanger design, effect of variable specific heat, effect of longitudinal heat conduction, effect of heat transfer from ambient, Regenerators, Regenerator design.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. R.F. Barron, _Cryogenic Systems', McGraw Hill, 1985.
2. R.B. Scott, _Cryogenics Engineering', Van Nostrand & Co., 1962.

Ref. Books

1. H. Weinstock, _Cryogenic Technology', 1969.
2. K. D. Timmerhaus and T. M. Flynn., _Cryogenic Process Engineering', Plenum Press, New York, 1989.
3. R. W. Vance., _Cryogenic Technology', John Wiley & Sons Inc., New York, London, 1971.
4. Sengapatha, A. Bose, _Cryogenics – Progress and Applications'

NAME OF THE SUBJECT					
Subject Code	**AIRCRAFT AND ROCKET PROPULSION**	L	T	P	C
MTEPE 2052		3	0	0	3

Course Outcome	
CO1	To be familiarity with common types of aircraft and spacecraft propulsion systems
CO2	Able to use of thermodynamic cycle analysis, including the thermodynamic treatment of chemically reacting systems
CO3	To understand the preliminary cycle design and performance analysis of propulsion systems for both aircraft and spacecraft
CO4	To acquire the knowledge of the basic operation and design requirements of propulsion turbo machinery components (inlets, compressors, combustors, turbines, afterburners, and nozzles).

UNIT:1 (10 Hours)

Introduction, Rocket system and aerodynamics of rockets, Fundamentals of gas turbine engines, Illustration of working principles of gas turbine engine, Propulsion system and operating principle, Thermodynamics of propulsion system, Engine performance parameters

UNIT:2 (14 Hours)

The ramjet cycle, Working principles of ideal ramjet cycle, The turbojet cycle, Working principles of turbojet cycle, Non-ideal turbojet cycle, Axial flow fans and compressors, Polytrophic efficiency of compression, Calculation of stage performance and overall performance, Working principles of turbofan cycle, Rocket performance

UNIT:3 (16 Hours)

Introduction and working principles of multistage rocket, Solid propellant rockets, Liquid propellant rockets ,Thrust control in liquid rockets Cooling in liquid rockets, Hybrid rockets, Limitations of hybrid rockets, Relative advantages of liquid rockets over solid rockets

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. G.C. Oates, *Aerothermodynamics of Aircraft Engine Components*, AIAA Education Series, New York, 1985.
2. W.W. Bathie, *Fundamentals of Gas Turbines*- John Wiley & Sons, 1984.

Ref. Books

1. M.L. Mathur, and R.P. Sharma, *Gas Turbine Jet and Rocket Propulsion*, Standard Publishers and Distributors, Delhi, 1988.

2. P.G. Hill, *Mechanics and Thermodynamics of Propulsion*- Addison Wesley, 1970.
3. S.M. Yahya, *Fundamentals of Compressible Flow* - John Wiley, New York, 1982.
4. A.K. Mohanty, *Fluid Mechanics* - Prentice Hall, New Delhi, 2003.

NAME OF THE SUBJECT					
Subject Code	**POWER PLANT AND PRACTICE**	L	T	P	C
MTEPE 2053		3	0	0	3

Course Outcome

CO1	To analyze different types of steam cycles and estimate efficiencies in a steam power plant.
CO2	To evaluate cycle efficiency and performance of a gas cooled reactor power plant
CO3	To understand Environmental impacts of energy use and various types of air pollution
CO4	To design various parameters on emission, control method and to understand the concepts of global warming.

UNIT:1 (10 Hours)

Overview of the Indian power sector, Thermodynamic analysis of conventional power plants. Advanced cycles, (combined cycles), IGCC, AFBC/PFBC, Overview of Nuclear power plants, Radio activity, Cross section, Fission process, reaction rates, diffusion theory, elastic scattering and showing down, criticality calculations, critical heat flux, power reactors, nuclear safety.

UNIT:2 (16 Hours)

Steam Turbine- superheater, reheater and partial condenser vacuum. Combined feed heating and Reheating Regenerative Heat Exchangers, Reheaters and Intercoolers in Gas turbine power plants. Hydro power plants – turbine characteristic. Auxiliaries – water treatment systems, Electrostatic precipitator, Flue gas desulphurisation –coal crushing /preparation – Ball mills/ pulverisers, ID/FD fans, Chimney cooling Towers, Power plants control systems-Review of control principles, combustion control, pulveriser control, control of air flow, furnace pressure and feed water, steam temperature control, safety provision/Interlocks. Analysis of system load curve- plant load factor, Energy Auditing, Methodology

UNIT:3 (16 Hours)

Environmental impacts of energy use-Air pollution –SOX, NOX, CO, particulates solid and water pollution formation of pollutants measurement and controls; sources of emission effect of operating and design parameters on emission ,control method, exhaust emission test, procedure standards and legislation; environmental audits; emission factors ad inventories Global warming, CO_2 emission, impacts, mitigation sustainability, externalities, future energy Systems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books 1. Power Plant Technology, M.M.Wakill, Tata McGraw Hill 2. Power Plant Engineering, P. K. Nag Tata McGraw Hill
Ref. Books 1. Boiler Control Systems, Lindsay, McGrawHill International, Lodon 2. Power Generation Operation and Control, A.J.Wood and B.F.Woolenberg, John Wiley, New York.

NAME OF THE SUBJECT					
Subject Code	**FINITE ELEMENT METHODS IN THERMAL ENGINEERING**	L	T	P	C
MTEPE 2054		3	0	0	3

Course Outcome

CO1	To apply basic principles of finite element analysis procedure
CO2	To understand the theory and characteristics of finite elements that represent engineering structures
CO3	To apply finite element solutions to structural, thermal, dynamic problem to Develop the knowledge and skills needed to effectively evaluate finite element analyze performed by others.
CO4	To represent the model complex geometry problems and solution techniques.

UNIT:1 (16 Hours)

Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of fem with other methods, variational approach, Co-ordinates, basic element shapes, interpolation function. Rayleigh- Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions . 1-D structural problems – axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape function. Analysis of Trusses – Plane Truss and Space Truss elements. Analysis of beams – Hermite shape functions – stiffness matrix – Load vector – Problems – analysis

UNIT:2 (14 Hours)

2-D problems –CST, force terms, Stiffness matrix and load vector, boundary conditions, Isoparametric element – quadrilateral element, Shape functions – Numerical Integration 3-D problems – Tetrahedran element – Jacobian matrix – Stiffness matrix

UNIT:3 (10 Hours)

Scalar field problems - 1-D Heat conduction – 1-D fin element – 2-D heat conduction Problems Dynamic considerations, Dynamic equations- consistent mass matrix-Eigen Values, Eigen Vector, natural frequencies-mode shapes-modal analysis.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Introduction to finite elements in engineering – Tirupathi K. Chandrupatla and Ashok
2. 2. D. Belagundu. /Prentice- Hall India

Ref. Books

1. The finite element methods in Engineering – S.S. Rao _ Pergamon, New York

2. An Introduction to Finite Element Methods – J. N. Reddy – Mc Grawhill
3. The Finite element method in engineering science – O.C. Aienkowitz, Mc Grawhill
4. Concepts and applications of finite element analysis – Robert Cook./ John Wiley & Sons
5. Finite Element Procedures in Engineering analysis – K.J Bathe

NAME OF THE SUBJECT					
Subject Code	**ADVANCED THERMAL ENGINEERING LABORATORY**	L	T	P	C
MTEES2160		0	0	8	4
Course Outcome					
CO1	Ability to know about calibration of temperature and solar radiation intensity				
CO2	To evaluate cycle efficiency and performance of the engine				
CO3	Analyze the variable compression ratio and exhaust gas effect				
CO4	To understand various parameters on emissivity, control method and to understand the concepts of global warming.				

ANY FIVE EXPERIMENTS

1. Calibration and selection of thermocouples.
2. Measurement of solar radiation intensity.
3. Plotting of isotherms by using temperature data logger.
4. Exhaust Gas analyser.
5. Mach-zehnder's interferometer and its application for capturing interferogram.
6. Effect of surface roughness on emissivity.
7. Effect of temperature on modulus of elasticity of a steel specimen.
8. Application of alternate fuels (green fuels, wood-gas, natural gas etc) on the performance of SI/CI engines and effect of variable compression ratio. .
9. Critical heat flux.

III SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**QP**
THEORY								
1.	OE	MTEOE3011	PROJECT MANAGEMENT AND COSTING	3	0		3	A
2.		MTEOE3012	RESEARCH METHODOLOGY	3	0		3	A
3.		MTEOE3013	HUMAN RESOURCE MANAGEMENT	3	0		3	A
PRACTICAL								
1.	ES	MTEES3120	THESIS I	0	0	36	18	
2.		MTEES4130	COMPREHENSIVE VIVA VOCE I	0	0	4	2	
TOTAL				**3**	**0**	**40**	**23**	

<table>
<tr><td colspan="6" align="center">NAME OF THE SUBJECT</td></tr>
<tr><td>Subject Code</td><td>PROJECT MANAGEMENT AND COSTING</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>MTEOE3011</td><td></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6" align="center">Course Outcome</td></tr>
<tr><td>CO1</td><td colspan="5">Gain the knowledge and confidence to manage a project from beginning to end</td></tr>
<tr><td>CO2</td><td colspan="5">Identify the different stages involved in project planning</td></tr>
<tr><td>CO3</td><td colspan="5">To understand the concept of Project Scheduling and to analysis the Project Feasibility</td></tr>
<tr><td>CO4</td><td colspan="5">To understand the concept of Break even analysis and overhead allocation Techniques.</td></tr>
<tr><td colspan="6">UNIT:1 (10 Hours)
Project Feasibility Analysis: Technical feasibility, commercial and financial viability, Environment Analysis.
Project Engineering: Project Management Techniques : PERT, CPM, Project Scheduling Crashing, PERT / COST, LOB.</td></tr>
<tr><td colspan="6">UNIT:2 (14 Hours)
Projects Financing alternatives, Sources of finance, their advantages, Choice of Financing mix, Capital budgeting.
Costing: Fixed and variable cost. Break even analysis, Overhead allocation Techniques.</td></tr>
<tr><td colspan="6">UNIT:3 (16 Hours)
Project Organisation, management and control: Project organisation and control staffing, monitoring: cost, time and control and progress monitoring techniques.
Product and service pricing: Availability and quality based pricing for services.</td></tr>
<tr><td colspan="6">Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.</td></tr>
<tr><td colspan="6">Text Books
1. Prasanna Chandra: Project Engineering and Management, Prentice Hall</td></tr>
<tr><td colspan="6">Ref. Books
1. Levy and Weist: Management guide to PERT / CPM, Prentice Hall</td></tr>
</table>

NAME OF THE SUBJECT					
Subject Code	**RESEARCH METHODOLOGY**	L	T	P	C
MTEOE3012		3	0	0	3

Course Outcome

CO1	To develop understanding of the basic framework of research process.
CO2	To understand various research designs and techniques.
CO3	To identify various sources of information for literature review and data collection.
CO4	To develop an understanding of the ethical dimensions of conducting applied research.

UNIT:1 (14 Hours)

Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs. Measurement and Data Collection. Primary data, Secondary data, Design of questionnaire ; Sampling fundamentals and sample designs. Measurement and Scaling Techniques, Data Processing.

UNIT:2 (14 Hours)

Data Analysis – I: Hypothesis testing; Z-test, t-test, F-test, Chi-square test. Analysis of variance. Non-parametric Test – Sign Test, Run test, Krushall – Wallis test

UNIT:3 (12 Hours)

Data Analysis – II: Factor analysis, Multiple Regressions Analysis. Discriminant Analysis, Use of SPS Package.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Research Methodology, Chawla and Sondhi, Vikas

Ref. Books

1. Research methodology by C.R. KOTHARI
2. Research Methodology, Paneersevam, PHI

NAME OF THE SUBJECT					
Subject Code	**HUMAN RESOURCE MANAGEMENT**	L	T	P	C
MTEOE3013		3	0	0	3

Course Outcome	
CO1	To discuss strategically plan for the human resources needed to meet organizational goals and objectives.
CO2	To define the process of job analysis and discuss its importance as a foundation for human resource management practice
CO3	To evaluate and critique an organization's selection process.
CO4	To explain and apply the legal principles that apply to a wide range of workplace issues

UNIT:1 (14 Hours)

Human Resource Development Strategies, Design And Experience

Human Resource Development: HRD-An Overview, Line Managers and HRD, Task Analysis, Motivational Aspects of HRD, Developmental Supervision, Counselling and Mentoring , HRD for Health and Family Welfare in Select HRD Culture and Climate, HRD for Workers, HRD/OD Approach to IR Corporate Business.

UNIT:2 (12 Hours)

Basics of Human Resource Planning

Macro Level Scenario of Human Resource Planning, Concepts and Process of Human Resource Planning, Methods and Techniques-Demand Forecasting, Methods and Techniques-Supply Forecasting, Job Evaluation: Concepts, Scope and Limitations, Selection and Recruitment, Induction and Placement, Performance and Potential Appraisal, Transfer, Promotion and Reward Policies, Training and Retraining.

UNIT:3 (14 Hours)

Wage and Salary Administration & Labour Legislation

Wage Concepts and Definition of Wages Under Various Labour Legislation, Norms for Wage Determination, Law relating to Payment of Wages and Bonus, Pay Packet Composition, Design of Performance-linked Reward System,

Philosophy of Labour Laws, Labour Laws, Industrial Relations and Human Resource Management, Indian Constitution and Labour Legislations

Time Management: Importance of Time factor, Time waster, Prioritizing Work Scheduling, Functions of the Time Office, Flexible Work arrangements.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

Text Books

1. Beardwell and Len Holder, Human Resource Management Macmillan India Ltd.,
2. Graham H.T., & R.Bennet, Human Resource Management – Pitman, London

Ref. Books

1. Performance Appraisal, Theory and Practice – AIMA VIKAS Management Series,
2. C.B. Manmoria, Personnel Management – Himalayan Publishing Co., New Delhi.
3. Pattanayak: Human Resource Management, PHI,
4. Nair,N.G. & Latha Nair:Personnel Management & Industrial Relations–S.Chand & Co.

IV SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
PRACTICAL								
1.	ES	MTEES4110	SEMINAR II	0	0	4	2	
2.		MTEES4120	THESIS II	0	0	36	18	
3.		MTEES4130	COMPREHENSIVE VIVA VOCE II	0	0	4	2	
TOTAL				**0**	**0**	**44**	**22**	