AISECT UNIVERSITY

A STATUTORY UNIVERSITY UNDER SECTION 2(f) OF THE UGC ACT

SCHEME OF EXAMINATION
&
DETAILED SYLLABUS

MASTER OF TECHNOLOGY (ME)
Thermal Engineering
M.Tech (ME)
Sem-I to IV

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COURSE STRUCTURE OF M.TECH (ME)

Semester –I			**Theory**		**Assignment**		
Subject Code	**Subject Name**	**Total Marks**	**Max Marks**	**Min Marks**	**Max Marks**	**Min Marks**	**Aggregate Pass Marks**
TMTP 101	Advanced Mathematics	100	70	25	30	11	36
TMTP 102	Thermodynamics & Combustion	100	70	25	30	11	36
TMTP 103	Heat and Mass Transfer	100	70	25	30	11	36
TMTP 104	Advanced Fluid Mechanics	100	70	25	30	11	36
TMTP 105	IC Engines & Alternate Fuels	100	70	25	30	11	36
Practical Group			**Term End**		**Lab Work**		
TMTP 106	Lab-I(Heat Transfer)	100	70	25	30	11	36
TMTP 107	Lab-II(I/C Engine)	100	70	25	30	11	36

COURSE STRUCTURE OF M.TECH (ME)

Semester –II			**Theory**		**Assignment**		
Subject Code	**Subject Name**	**Total Marks**	**Max Marks**	**Min Marks**	**Max Marks**	**Min Marks**	**Aggregate Pass Marks**
TMTP 201	Thermal Power Plant Engg.	100	70	25	30	11	36
TMTP 202	Design Of Heat Exchangers	100	70	25	30	11	36
TMTP 203	Advance Refrigeration System	100	70	25	30	11	36
TMTP 204	Steam And Gas Turbines	100	70	25	30	11	36
TMTP 205	Maintenance Of Thermal Power Plant	100	70	25	30	11	36
Practical Group			**Term End**		**Lab Work**		
TMTP 206	Lab-III(Maintenance of Thermal Power Plant)	100	70	25	30	11	36
TMTP 207	Lab-IV(Advance Refrigeration and Air conditioning Systems)	100	70	25	30	11	36

COURSE STRUCTURE OF M.TECH (ME)

Semester –III			**Theory**		**Assignment**		
Subject Code	**Subject Name**	**Total Marks**	**Max Marks**	**Min Marks**	**Max Marks**	**Min Marks**	**Aggregate Pass Marks**
TMTP 301(A)	Elective - I	100	70	25	30	11	36
TMTP 302(B)	Elective - II	100	70	25	30	11	36
Practical Group			**Term End**		**Lab Work**		
TMTP 303	Seminar	100	70	25	30	11	36
TMTP 304	Dissertation Part- I (Literature Review/Problem Formulation/ Synopsis)	100	70	25	30	11	36

ELECTIVE - I 301 (A) Computer Aided Design Of Thermal System

301 (B) Engine System Modeling And Analysis

ELECTIVE - II 302 (A) Engine System Modeling And Analysis

302 (B) Non Conventional Energy Sources

302 (C) Pumps, Blowers and Compressors

	Semester –IV			End sem		Assignment		
Subject Code	**Subject Name**	**Credits**	**Total Marks**	**Max Marks**	**Min Marks**	**Max Marks**	**Min Marks**	**Aggregate Pass Marks**
TMTP 401	Dissertation Part-II	20	500	300	150	200	100	250
	TOTAL	20	500	300	150	200	100	250

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Scheme of Examination

Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP - 101	Advance mathematics	4(3-1-0)	70	20	10	-	-	100	3 hr	-

TMTP-101 Advanced Mathematics

Course outcomes:

1. Students will be able to analyze and develop the mathematical model of thermal system.
2. Student should able analyze the reliability and maintainability of the series and parallel thermal system.
3. Students will be able to solve differential equations using numerical techniques.

SYLLABUS

UNIT –I

Linear Algebra: Linear transformation, vector spaces, hash function, Hermite polynomial, Heavisite's unit function and error function. Elementary concepts of Modular mathematics

UNIT -II

Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabolic) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.

UNIT -III

Probability, compound probability and discrete random variable, Binomial, Normal and Poisson's distributions, Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations

UNIT- IV

Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Application of Eigen value problems in Markov Process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)

UNIT- V

FEM: Variational functionals, Euler Lagrange's equation, Variational forms, Ritz method, Galerkin's method, descretization, finite elements method for one dimensional problems.

REFERENCE BOOKS:

1. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
2. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.

3. Applied Numerical Methods with MATLAB by Steven C chapra, TMH.
4. Advance Engineering Mathematics, O'Neil, Cengage (Thomson)
5. Introductory Methods of Numerical Analysis by S.S. Shastry,
6. Krishmurthy Finite element TMH
7. Buchanan Finite element analysis(Schaum Outline S) TMH
8. Numerical Solution of Differential Equation by M. K. Jain
9. Numerical Mathematical Analysis By James B. Scarborogh
10. Fourier Transforms by J. N. Sheddon
11. Advance Mathematics for Engr and Sc, Spiegel, Schaum Series, TMH

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Scheme of Examination

Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP - 102	Thermodynamics and combustion	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-102 Thermodynamics and Combustion

Course objectives:

To Provide analytical methods for the determination of the direction of processes from the first and second laws of thermodynamics and to Introduce methods in using equations of potentials, availability, and excergy for thermodynamic analysis

Gain the knowledge on non-reactive mixture properties , Psychrometric Mixture properties and psychrometric chart and Air conditioning processes

Develop the ability of analyzing vapor and Gas power cycles

Provide in depth knowledge of Direct Energy Conversion of Fuel Cells , Thermo electric energy ,Thermionic power generation ,Thermodynamic devices Magneto Hydrodynamic Generations and Photo voltaic cells

Develop communication and teamwork skills in the collaborative course project

Course outcomes:

1. Student will get Knowledge of exergy, basic laws governing energy conversion in multi-component systems and application of chemical thermodynamics.

2. Student will be aware about advanced concepts in thermodynamics with emphasis on thermodynamic relations, equilibrium and stability of multiphase multi-component systems.

3. Student will be aware about the molecular basis of thermodynamics.

4. To present theoretical, semi-theoretical and empirical models for the prediction of thermodynamic properties.

5. Student will be acquire the confidence in analyze the motion of combusting and non-combusting fluids whilst accounting for variable specific heats, non-ideal gas properties, chemical non-equilibrium and compressibility.

6. Student should apply the fundamental principles of thermodynamics to non ideal models of numerous engineering devices Student can use a systems approach to simplify a complex problem.

SYLLABUS

UNIT-I

Classical Thermodynamics: Concept of classical thermodynamics, review of zeroth, first and second law of thermodynamics. Availability analysis of thermal system and concept of energy conservation.

UNIT -II

Phase and reaction equilibriums: Equilibrium constants .calculation of equilibrium composition of multi components gaseous mixtures

UNIT- III

Equations of state: Equations of state & calculations of thermodynamics and transport properties of substances, reaction rates of first ,second and higher order reactions, reactions in gaseous, liquid and solid phases

UNIT -IV

Equilibrium, real substances and properties, triple point, critical point, temperature entropy, entropy-enthalpy charts, Vanderwal's equation of state, Claperon's equation, Gibbs phase rule, law of corresponding states

UNIT -V

Combustion and flames: combustion and flame velocities, Laminar and turbulent flames. Premixed and diffusion flames: their properties and structures. Theories of flame propagation, combustion of solid, liquid and gaseous fuels, combustion of fuel droplets and sprays, combustion systems, combustion in closed and open systems, application to IC engines , boilers, gas turbine, combustors and rocket motors.

RECOMMENDED BOOKS:

1. Heat Power and Thermodynamics by M.W.Zemansky (McGraw Hill).
2. Combustion, Flames and explosions of gases, B.Lewis and G.Von Elbe Academic P.
3. Thermal Sciences, Potter, Cengage Learn (Thomson)
4. Engineering thermodynamics by Gurdon Rogers Yon Mayhew.
5. Concept of thermodynamics by Obert (McGraw Hill).

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Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP - 103	Heat and mass transfer	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-103 Heat and Mass Transfer

Course outcomes: With this subject curriculum the students are expected to understand the subject of Heat Transfer in detail with capability to solve Industrial Problems. This will also create the base and interest among the students to carry out the Future Research

SYLLABUS

UNIT-I

Introduction: Modes of heat flow, Basic laws of heat transfer. Combined heat transfer Mechanisms. Conduction: Steady state conduction, System with internal generation of heat, Transient Conduction, Extended surfaces (Fins), Multi-dimensional heat transfer problems, Phase change, Heat transfer with moving bodies.

UNIT -II

Convection: Governing Equations in Laminar & Turbulent Flow, Free and Forced Convection, Tubes, Ducts and exterior surfaces, tube bundles in cross flow, Correlations,

Dimensional analysis.

UNIT -III

Boiling heat transfer, nature of vaporization, nucleate pool boiling and empirical correlations for pool boiling heat transfer, factors affecting pool boiling film coefficients, high heat flux boiling. Condensation: Physical Mechanisms, Laminar film condensation on a vertical plate, turbulent film condensation, drop wise condensation.

UNIT -IV

Radiation: Radiation Properties & Law, Electrical analogy, Radiation exchange between surfaces, Applications to cavities & enclosures.

UNIT -V

Mass transfer: equation for convective mass transfer, boundary layer mass transfer, empirical correlation for convective mass transfer.

REFERENCE BOOKS:

1. Heat Transfer, Krieth, Cengage learn (Thomson)
2. Heat transfer by J.P. Holman.
3. Analysis of Heat transfer E.R.G.Eckerst and R.M. Drake Jr. McGraw Hills.

4. Heat mass and momentum transfer .W.M.Roshenow and P.Choi, Prentice Hall .
5. Heat transfer B.Gebhart ,McGraw Hills .
6. Conduction Heat Transfer V.S. Arpaci ,Addison Wesley .
7. Thermal radiation H.C. Hotel .

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Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-104	Advance fluid mechanics	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-104 Advanced Fluid Mechanics

Course outcomes:

1. Students will be able to explain concepts of fluid dynamics such as Lagrangian method, Eulerian method, Material Derivative, Translation, Rate of deformation and Rotation, Vorticity, Generalized Expression of the Movement of a Fluid Element.
2. Students will be able to develop governing equations, such as continuity equation, momentum equations and energy equation in integral forms and differential forms and applying these to the various control volumes.
3. Students will be able to derive Euler's equation for ideal fluid and Navier-Stokes Equation for viscous fluid by using control volume approach. 4. Students will be able to explain concepts of boundary layer theory such as Prandlt boundary layer equation, Blasius flow over a flat plate and speed of sound, Stagnation and Sonic Properties, Isentropic flow through convergent–divergent nozzles and Normal Shocks.

SYLLABUS

UNIT -I

Reviews of basic laws, concept of continuum, fluid flow in Integral & differential form

UNIT -II

Kinematics of Fluid: Description of properties in a moving fluid, Local and material derivatives, Control mass and control volume analysis, Reynolds Transport theorem and its application.

UNIT -III

Ideal fluid flow: Introduction, Elementary flows in a 2-D plane, Flow nets, superposition of Elementary flows.

UNIT -IV

Viscous Incompressible Flows: Introduction, Equations of motion, N-S equations and its application. Boundary Layer Theory: Prandtl's boundary layer equations, Flat plate boundary layer, approximate solution - Integral method, Laminar and turbulent boundary layer, Separation, Lift and Drag

UNIT -V

Fundamental of Compressible flows: Introduction, Thermodynamic relations of perfect gases, Speed of sound, pressure wave propagation, Stagnation and Sonic properties, Shocks.

UNIT –VI

Hydraulic machines: Theory and design of hydro-turbines and centrifugal pumps, their proto-type testing.

REFERENCE BOOKS:

1. Fluid Mechanics by Shames (McGraw Hill).
2. Mechanics of Fluid by Massey (EL-BS).
3. The Dynamics and Thermodynamics of Compressible Fluid flow A.H. Shapiro .
4. Boundary Layer Theory H. Schlichting McGraw Hills.
5. Thermal Sciences, Potter, Cengage Learn (Thomson)

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Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP - 105	IC engine & alternate fuels	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-105 IC Engines & Alternate Fuels

Course outcomes:

1. Appreciate and check the working of IC engines taking environmental issue and performance into consideration.
2. Analyze combustion in CI and SI engines for and modify the design of combustion chamber.

SYLLABUS

UNIT -I

SI Engines: Fuels for use in S.I. Engines; Rating of S.I. Engines fuels, carburetors and carburetion, fuel injection systems; Combustion in S.I. Engines-normal and abnormal, detonation, stratification and lean mixture operations. Carburetor replacement by MPFI, Elements of MPFI System like control unit, sensors, switches, Effect on engine performance & Engine Emission.

UNIT -II

Performance & testing of I.C. Engine: Introduction, breathing capacity, pumping losses, friction losses, super charging, performance parameters & their measurements for S.I.E. & C.I.E. Engine, performance maps. Air and sound pollution by engines, remedial measures;

UNIT -III

Non Conventional I.C. Engines : Dual Fuel, Multi Fuel, Stratified charge lean burn variable compression ratio, Rotary Engines, Description, Working and comparison with conventional I.C. Engines.

UNIT -IV

Future Fuels for Ignition Engines : Introduction, Necessity for substitute Fuels.
Substitute future fuels like Ethanol, Methnol, Bio gas, Hydrogen, Production, Transportation, storage of substitute fuel, performance of engines using these fuels.

REFERENCE BOOKS:

1. A.S. Khatchiian ;Theory of C.I. Engines Vol.1 and 2 IIT Bombay .
2. C.F. Taylor and E.S. Taylor; Internal Combustion Engines ,Stanton

3. P.G. Burman and B.Luca Fuel injection and Engines, Technical Press
4. L.C. Litchy ,Combustion Engines Processes, McGraw-Hill
5. E.F. Obert ,Internal Combustion Engines and Air Pollution , Intext Educational Publishers
6. H.R. Ricardo , The High Speed I.C. Engine, Blackie, London.

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Scheme of Examination

Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-106	THERMAL ENGG. LAB – I	2(0-0-2)				70	30	100	3 hr	3 hr

TMTP 106 Lab-I (Heat Transfer)

Course outcomes:

1. Apply the concepts of heat transfer in three modes to real problems.
2. Design of heat exchangers and mass transfer systems.

SYLLABUS

VARIOUS EXPERIMENTS IN HEAT TRANSFER

1. Determination of LMTD and Overall Heat Transfer Coefficient of a Parallel Flow Heat Exchanger.
2. Determination of LMTD and Overall Heat Transfer Coefficient of a Counter Flow Heat Exchanger.
3. Determination of Overall Heat Transfer Coefficient of a Double Pass Heat Exchanger.
4. Determination of Overall Heat Transfer Coefficient for Cross Flow Air/Water Heat Exchanger.

PERFORMANCE OF HEAT PIPE AS COMPARED WITH THERMAL SIPHON AND AIR PIPE.

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Heat transfer in Forced Convection.
3. Dropwise and Filmwise Condensation.
4. Determination of Stefan Blotzman constant by Stefan Boltzman apparatus.

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Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP - 107	THERMAL ENGG. LAB – II	2(0-0-2)				70	30	100	3 hr	3 hr

TMTP 107 Lab-II (I/C Engine)

1. Appreciate and check the working of IC engines taking environmental issue and performance into consideration.
2. Analyze combustion in CI and SI engines for and modify the design of combustion chamber.

SYLLABUS

1. To Determine Volume Flow Rate for Low Speed Wind Tunnel using Pitot Tube.
2. To study Flow around Circular/Irregular Shaped Body.
3. Heat Balance Sheet for C.I./I.C Engines.
4. To find effect of compression ratio on I.C. Engine Performance.
5. Study of Experimental Facility on Steam Turbine.
6. To conduct Numerical Experiments with Software for exploration of problems related to Fluid and Heat Transfer using the software.

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SEMESTER-II

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Scheme of Examination

Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP - 201	Thermal power plant engg.	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-201 Thermal Power Plant Engg.

Course outcomes:

1. To know the current energy scenario in India.
2. To know the layout of various types of power plant.
3. To know about working of cycles and steam boilers.
4. Understand the government policies and environmental issues.
5. To know about working of combined power cycle.

SYLLABUS

UNIT 1

Conventional thermal power plants, super-critical power plants and its principles of working, performance curves and flow diagrams.

UNIT 2

Power plant components: Fuel and ash handling, pulverized fuel firing burners, dust handling, fluidized bed combustion. Radiant super heaters and re-heaters, economizer and pre-heaters, combustion and furnace design, boiler water supply and treatment. Drat and arrangement of draft fans, different types of cooling systems, open closed, mixed and dry cooling tower systems, air cooled condensers. Ejector and vacuum pumps, feed heating systems, heaters, evaporators and de-airator, feed line protection, boiler feed pumps, different type of drives for it, steam turbine driven feed pumps.

UNIT 3

Plant instrumentation for thermal power plants, need and importance, distributed and centralized, pneumatic and electro-mechanical transducers and controllers, distributed computer control. Piping and insulation: design and layout of ducting for air fuel, gases and pulverized fuels, selection of piping, pipe flexibility analysis, Various control valves and actuators. Insulation optimum thickness and costs.

UNIT 4

Installation, commissioning and operation: Preliminary performance checks and acceptance test

for various components, heat balance of items and entire plant. Starting loading and normal operation checks, maintenance logging, parallel operations, droop setting, performance analysis, maintenance, safety and pollution controls.

UNIT 5

Plant Management: Preparing specifications and contract documents, guarantee. Training of power plant personnel, safety, and seismic analysis. Purchase and contract for fuel supplies.

REFERENCE BOOKS:

1. Power Plant Engineering, F T Morse
2. Power Plant Engineering, P K Nag
3. Power Plant Engineering, Arora and Domkundwar

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Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-202	Design of heat exchangers	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-202 Design of Heat Exchangers

Course outcomes:

1. Students will demonstrate a basic understanding of several types of heat exchangers that will include shell-and-tube, double pipe, plate-and-frame, finned tube, and plate-fin heat exchangers, Heat pipes.
2. Students will design and analyses of shell-and-tube double pipe, compact, plate heat exchangers.
3. Students will demonstrate the performance degradation of heat exchangers subject to fouling.

SYLLABUS

UNIT 1

Types of Heat Exchangers, definitions & quantitative relationship

UNIT 2

Analytical & Numerical solution Procedures, Fouling factors, Correction factors

UNIT 3

Thermal & hydraulic design of Commonly used heat exchangers : Double pipe heat exchangers , shell and tube heat exchangers, condensers, Evaporators, Cooling and dehumidifying coils, Cooling towers, Evaporative condensers , design of air washers , desert coolers .

UNIT 4

Review of mechanical Design, TEMA Codes Materials of Construction , corrosion damage , Testing and inspection .

UNIT 5

Heat Pipe: Basics & its mathematical model , micro Heat Exchangers. Use of software in heat exchanger design.

REFERENCE BOOKS:

1. Compact Heat Exchangers Kays and London, TMH
2. Heat Exchangers- Thermal Hydraulic fundamentals and design, Kokac, TMH
3. Extended Surface Heat Transfer, D Q Kern, A D Kraus, TMH.
4. Tubular Exchanger Manufacturer Association (TEMA), and other codes.

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Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-203	Advance refrigeration system	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-203 Advance Refrigeration System

Course outcomes:

1. In this subject curriculum the students are expected to understand the subject of Refrigeration and cryogenics, and its application area.

2. The another intention of this subject is to develop and design the refrigeration and cryogenics system for various industrial, medical, space and other application. This will also create the base and interest among the students to carry out the Future Research.

SYLLABUS

UNIT 1

Introduction: Thermodynamics Properties of pure and Mixed Refrigerants and their selection. Vapor Compression System, Actual Vapor Compression System, Deviation from theoretical System, Multi-pressure System with Flash Chamber and Inter Cooling, Cascade system.

UNIT 2

Refrigeration Equipments: Compressors, Analysis and Thermal Design of Reciprocating, Centrifugal and Screw Compressors, Performance Characteristics & Capacity control. Expansion Devices: Capillary, Automatic and Thermostatic Expansion Valve. Other Equipments: Liquid Receiver, Oil Separators, Liquid Line Strainers, Driers, Liquid Sub coolers.

UNIT 3

Condenser & Evaporator: Types, performance & Their Controls.

UNIT 4

Thermodynamics of Refrigerant: Absorbent Combinations, Analysis of simple and Industrial Vapor Absorption system using various working fluids Solar Powered Refrigeration & Heat Pump.

BOOKS:

1. Refrigeration & Air Conditioning by W.F.Stoecker
2. Refrigeration & Air Conditioning by C.P.Arora
3. Refrigeration & Air Conditioning by Manohar Prasad

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			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-204	Steam and gas turbine	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-204 Steam and Gas Turbines

Course outcomes:

1. Student should understand construction and design features of gas turbines as used for power generation.
2. Student should understand thermodynamics cycles a, and different sizes and layouts of gas turbine plant.
3. Able to understand thermodynamics and fluid mechanics component for enhancing the efficiency and effectively of gas turbines

SYLLABUS

UNIT 1

STEAM TURBINES:

Principle and working of steam turbines, type of turbines, impulse and reactions, compounding for pressure and velocity. Velocity triangles for various types, stage to blade, speed ratio for optimum efficiency, diagram efficiency, steam s

performance. Energy losses in steam turbine, turbine performance at various loads and governing of steam turbines. Constructional details and description of steam turbine components in brief.

UNIT 2

REGENERATIVE FEED HEATING CYCLES:

Introduction : Most Ideal Regenerative f eed heating cycle. Regenerative feed heating cycles and their represenation on T-s and h-s Diagram. Representation of actual process on T-s and h-s Diagram Regenerative cycles. Other types of feed heating arrangements. Optimum feed water temperature and saving in Heat Rate. Feed Heaters, Direct Contact Heaters, Surface Heaters, Deaerators .

UNIT 3

REHEATING - REGENERATIVE AND REGENERATIVE WATER - EXTRACTION CYCLES.

Reheating of steam, Practical reheating and Non- reheating cycles, advantage & disadvantages of reheating, regenerative water extraction cycles, practical feed heating arrangements. Feed heating system for 120MW, 200MW, 350MW, 500MW & 660 MW Units.

UNIT 4

MIXED PRESSURE TURBINES:

Low- pressure Turbines, Mixed pressure Turbines, Heat Accumulators.

UNIT 5

GAS TURBINES:

Open and closed cycles, constant pressure and constant volume cycles, cycles with inter cooling, reheating and heat exchanger, compressor and turbine efficiencies, pressure losses, performance characteristics of various cycles, practical problems.

Jet Propulsion: Calculation of thrust, Power, speed and efficiency, turbo - jet and turbo propulsion systems.

REFERENCE BOOKS:

1. Fluid dynamics and heat transfer of turbo-machinery, Budugur Lakshminarayana, Amazon.com
2. Cohen H Rogers, Sarvanmutto, Gas Turbine Theory, Longman Pub.
3. Mathur, Sharma, Gas turbine, Standard Pub And Distributors Delhi.

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Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-205	Maintenance of thermal power plant	4(3-1-0)	70	20	10			100	3 hr	3 hr

TMTP-205 Maintenance of Thermal Power Plant

Course outcomes:

1. Understands the operation of various power plant in India.

2. Understands the process of maintenance of steam boiler and equipments.

3. To know about working of combined power cycle with their advantages.

4. Understand the government rule /legislation regarding maintenance of the thermal power plant.

SYLLABUS

UNIT 1

Maintenance Management: emergency maintenance procedure Maintenance strategies, maintenance schspare part management, inventory control purchase procedure and storage, Warning systems, organization of maintenance department, human consideration.

UNIT 2

DIAGNOSTIC MAINTENANCE AND MACHINE HEALTH MONITORING:

Introduction to maintenance techniques, preventive and predictive maintenance, signature analysis, observational and estimation techniques, online techniques specially dealing with instrumentation system, off-line techniques, non-destructive testing, practical application of diagnostic maintenance to specific industrial machinery and plants. Various techniques of condition monitoring wear analysis, vibration and noise signature, thermography etc.

UNIT 3

MECHANISM OF LUBRICATION & LUBRICANTS:

Lubrication regimes, analysis and modes of lubrication in different bearings, squeeze films, fluid film, elasto-hydrodynamic and boundary lubrications theories and applications, environmental effects on lubrications, types of lubricant and properties, non-conventional lubricants and applications.

UNIT 4

FAILURE MECHANISMS AND ANALYSIS:

Material failure due to environmental effects, Introduction; Importance of failure analysis, common causes of failure in metals & alloys. Failure due to faulty heat treatment,

embrittlement of metals, Residual stresses in metals, and their effects. Defects in production and manufacture. Design faults, analysis of engineering failures, failure due to abuse of machinery, failure of seals & packing, failure of bearings, failure of gears, fatigue failure, failure due to time-temperature effects(creep) corrosion etc.

UNIT 5

MAINTENANCE OF POWER PLANT MACHINERY;

Predictive and preventive maintenance of steam turbine and its components, Erosion of blades and its prevention. Lubrication of bearings, valves, Maintenance scheduling, methods of detection of leaking and its prevention in the condensers. Condenser fault systems and its cases. On load and off load cleaning of condenser tubes, Maintenance scheduling of cooling water plants, cooling towers, Life enhancement techniques, case studies.

REFERENCE BOOKS:

1. Maintenance & Spare Parts & Management - P. Gopal Krishnan & Bannergee
2. Maintenance Engg. Handbook - by Lindley & Higgins
3. Industrial Maintenance Management - by Neibel
4. Reliability Centered Maintenance - by Moubray
5. Maintenance Engg. & Management - By R.C. Mishra
6. Modern Power plant Practice - 10 Volumes British Electricity Int. Ltd.
7. Power Generation Handbook - Philip Kaimeh. Mc Graw HCourse

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AISECT UNIVERSITY, Bhopal, (M.P.)

Scheme of Examination

Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-301	Elective-I	4(3-1-0)	70	20	10			100	3 hr	3 hr

MMTP - 301 (A) COMPUTER AIDED DESIGN OF THERMAL SYSTEM

Course outcomes: With this subject curriculum the students are expected to understand the subject of Computational Fluid Dynamics and know how to use it as tool to solve the Heat Transfer and Fluid Mechanics related Industrial Problems. This will also create the base and interest among the students to carry out the Future Research.

SYLLABUS

UNIT 1

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

UNIT 2

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

UNIT 3

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

UNIT 4

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

UNIT 5

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

REFERENCE BOOKS:

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

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MMTP - 301 (B) ENGINE SYSTEM MODELLING AND ANALYSIS

UNIT 1

Basic simulation modeling : Nature of simulation, so the system concept, system environment, continuum and discrete system , system modeling, Types of models like static physical, Dynamic physical and mathematical models, principle and in modeling block building relevance, accuracy and aggregation.

UNIT 2

Probability Concept in Simulation: Stochastic variables, discrete and continuum probability function, Measures of probability function, Estimation of means variance, standard deviation.

UNIT 3

Actual cycles of Engine operation, their analysis, Use of combustion charts, simulation of engine processes like, suction, compression, evaporation and exhaust. Basic engine operating cycles their analysis and simulation Development of computer programs for these.

UNIT 4

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

REFERENCE BOOKS:

1. Simulation modeling and analysis - Averill M. Law, WD Kelton, TMH.
2. System Simulation - Geoffrey Gordon, Prentice Hall
3. Discrete System simulation - Jerry Banks, John S. Carson, PHI.
4. Seila, Applied Simulation Modeling, Cengage (Thomson)

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AISECT UNIVERSITY, Bhopal, (M.P.)

Scheme of Examination

Department: Mechanical

Subject Code	Subject Name	Credits	Maximum marks Allotted						Duration of Exam.	
			Theory			Practical		Total	Theory	Practical
			End Sem	Mid Sem	Assign.	End Sem	Term work			
TMTP-302	ELECTIVE-II	4(3-1-0)	70	20	10			100	3 hr	3 hr

302 (A) Engine System Modeling And Analysis

Course outcomes:

1. Students will demonstrate a basic understanding of several types of engine models that will include zero dimensional thermodynamic model, one dimensional and multi dimensional, single zone, two zone etc models.

2. Students will develop models and simulate them for diesel engine petrol engine, gas engine.

3. Students will demonstrate the performance evaluation and emission standards for such modeled engines.

SYLLABUS

UNIT 1

Fundamental Equations of Steady Flow:

Continuity equation, Equations of Motion, Euler's Equation, Bernoulli's equation, Energy,

Stream Function and Velocity Potential,

UNIT 2

Potential Flow:

Elementary potential flow, Source, Sink, Vortex and Doublet, Superposition of flow patterns.

Flow over immersed bodies. Development of the aerofoil-lift and drag, Kutta- Joukowski

Profile, pressure distribution over aerofoil blading.

UNIT 3

Viscous Flow:

Incompressible Flow: Laminar Turbulent Flows: Navier's Strokes equation and exact

solutions of steady flow problems. Flow through pipes, over flats plates. Laminar and

turbulent boundary layers. Dimensional analysis.

UNIT 4

Compressible Flow of Gases:

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

UNIT 5

Cascade Tests:

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

REFERENCE BOOKS:

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

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MMTP - 302 (B) NON CONVENTIONAL ENERGY SOURCES

Course outcomes:

1. Update about the technological status of implementation of NCES in India.

2. Capable to analyze various techno economical obstacles in the commercial development of NCES in India.

3. Capable to conceptually model and design general NCES systems and predict the long term performance.

4. Suggest and plan hybrid NCES solutions to conventional energy systems

UNIT 1

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

UNIT 2

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

UNIT 3

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

UNIT 4

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

UNIT 5

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

UNIT 6

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

REFERENCE BOOKS :

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

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MMTP - 302 (C) PUMPS, BLOWERS AND COMPRESSORS (TO BE EXPANDED)

Course outcomes:

1. Understands the operation of various pumps, blowers and compressor.

2. Understands the process of maintenance of pumps, blowers and compressor.

3. To know about manufacturer catalogue of the instruments.

SYLLABUS

Law of momentum .Vortex theory of Euler's head. Hydraulic performance of pumps ,Cavitation.

Jet Pumps : Turboblowers and their characteristics ,cooling tower fan ,Surging .Design of pumps ,blowers, compressors and fans .

REFERENCE BOOKS :

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

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AISECT UNIVERSITY, Bhopal, (M.P.)

Scheme of Examination

	Semester –IV			End sem		Assignment		
Subject Code	Subject Name	Credits	Total Marks	Max Marks	Min Marks	Max Marks	Min Marks	Aggregate Pass Marks
TMTP -401	Dissertation Part-II	20	500	300	150	200	100	250
	TOTAL	20	500	300	150	200	100	250

TMTP 401 Dissertation Part-II

OUTCOMES:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

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