

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru) CHOICE BASED CREDIT SYSTEM (CBCS)

SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE

(Effective from the academic year 2024-2025)

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech (THERMAL POWER ENGINEERING)



1st SEMESTER MTech

SI		Course Code	Course Title	Teaching	L	Т	P	Credits	CIE	SEE	Total	Exam
No				Dept.	2	-	_	Creares	Marks	Marks	Marks	Hrs.
1	PC	24TPE11	Applied Mathematics	MA	4	-	-	4	50	50	100	3
2	PC	24 TPE 12	Advanced Power Plant Cycles	ME	4	-	-	4	50	50	100	3
3	PC	24 TPE 13	Advanced Fluid Mechanics	ME	4	-	-	4	50	50	100	3
4	PC	24 TPE 14	Combustion Engineering Science	ME	3	-	-	3	50	50	100	3
5	PE	24 TPE 15x	Professional Elective-I	ME	3	-	-	3	50	50	100	3
6	PE	24 TPE 16x	Professional Elective-II	ME	3	-	-	3	50	50	100	3
7	PC	24 TPE TS1	Technical Seminar-I	ME	-		3	1.5	50	-	50	-
8	PC	24 TPE LB1	Thermal Engineering Laboratory	ME	-	-	3	1.5	50	-	50	-
	L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination		Total	21	-	6	24	400	300	700	-	

	Professional Elective-I	Professional Elective-II					
24TPE151	Energy Conservation and Management	24TPE161	Theory of IC Engines				
24TPE152	Thermal Power Station	24TPE162	Refrigeration and Air Conditioning				
24TPE153	Modeling & Simulation of Thermal Systems	24TPE163	Experimental Methods in Thermal Power Engineering				



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2nd SEMESTER MTech

SI No	Course Code Course Title		Teach ing Dept.	L	Т	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.	
1	PC	24 TPE 21	Heat Transfer	ME	4	-	-	4	50	50	100	3
2	PC	24 TPE 22	Turbomachines	ME	4	-	-	4	50	50	100	3
3	PC	24 TPE 23	Finite Element Method	ME	4	-	-	4	50	50	100	3
4	PC	24 TPE 24	Advanced Design of Heat Transfer Equipments	ME	3	-	i	3	50	50	100	3
5	PE	24 TPE 25x	Professional Elective-III	ME	3	-	-	3	50	50	100	3
6	PE	24 TPE 26x	Professional Elective-IV	ME	3	-	-	3	50	50	100	3
7	PC	24 TPE TS2	Technical Seminar-II	ME	-	-	3	1.5	50	-	50	-
8	PC	24 TPE LB2	CAE Laboratory	ME	-	-	3	1.5	50	-	50	-
	L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination		Total	21	-	6	24	400	300	700	-	

	Professional Elective-III	Professional Elective-IV						
24TPE251	Alternate Fuels for IC Engine	24TPE261	Solar Thermal Technologies and applications					
24TPE252	Computational and Fluid Dynamics	24TPE262	Design and Analysis of Thermal Systems					
24TPE253	Convective heat transfer	24 TPE263	Engine Flow and Combustion					



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3rd SEMESTER MTech

SI No			Course Title	Teaching Dept.	L	Т	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PC	24 TPE IS1	Internship	ME	-	-	-	9	100	-	100	-
2	PC	24 TPE NE1	Online Courses:NPTEL/MOOC/Swayam	ME				3	50	50	100	
3	PC	PC 24 TPE PW1 Project Phase-I		ME	-	-	-	8	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal			Total	-	-	-	20	150	50	150	-	
Evalu	Evaluation, SEE: Semester End Examination											ļ

4th SEMESTER MTech

SI	Course Code Course Title		Teaching	L	T	P	Credits	CIE	SEE	Total	Exam	
No	No		Dept.					Marks	Marks	Marks	Hrs.	
1	1 PC 24 TPE PW2 Professional Work Phase-II				-	-	-	20	100	200	300	-
2 Pap	er Pub	lications is con	npulsory (Conference/Journal)									
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				Total	-	-	-	20	100	200	300	-

Credits Distribution: 1st Sem=24, 2nd Sem =24, 3rd Sem=20, 4th Sem=20,

Total Credits=24+24+20+20=88 Credits

Total Credits: 24+24+20+20=88



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(Effective from the academic year 2024-2025) DEPARTMENT OF MECHANICAL ENGINEERING M.Tech (THERMAL POWER ENGINEERING)

Department: Mathema	Semester:	I									
Subject:Applied Mathematics (M.Tech) (Common to: Electrical -CAID and Mechanical (TPE)											
Subject Code:	24TPE101/24CAI101		L-T-P-C:	4-0-0-4							

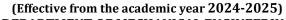
SI. No	Course Objectives													
1	Acquaint with principles of linear algebra, probability theory and Numerical methods.													
2	Apply the knowledge of linear algebra, probability theory and random process in the applications of electronics and communication engineering sciences.													
3	To understand the concepts of the stochastic process of a statistic and estimation of parameters arising in engineering field.													
4	To study the queuing models and sampling distributions.													

Unit	Description	Hrs
I	Linear Algebra-I	10
	Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis of vector space. Linear transformations- definition, properties and problems. Matrix form of linear transformations-Illustrative examples.	
II	Linear Algebra-II	10
	System of Linear Algebraic Equations and Eigen Value Problems: Gauss – Seidal Iterative method. Eigen value problems- Finding all the Eigen values and Eigen vectors, Gerschgorial circle, Computation of Eigen values and Eigen vectors of real symmetric matrices by QR decomposition, singular value decomposition.	
III	Numerical Methods: Solution of algebraic and transcendental equations-	10
	Newton- Raphson method for simple roots and multiple roots. Rate of	



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	convergence of Newton- Raphson method. System of non-linear equations by Newton- Raphson method. Polynomial equations by Birge – Vieta method and Bairstow method.										
IV	Solution of Simultaneous Linear Algebraic Equations: Introduction, Engineering Applications, Basic III-Conditioned Equations. Graphical Interpretation of the Solution, Solution Using Cramer's Rule, LU Decomposition Method, Relaxation Methods.	11									
V	Probability Theory Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions.	11									

Course Outcomes:

Course outcome	Descriptions
CO1	Acquaint with principles of linear algebra, probability theory and Numerical methods.
CO2	Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.
CO3	Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields.
CO4	To study the concept of probability distributions with probability generating functions

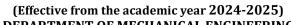
Course Articulation Matrix

PO/PSO CO	PO1	P02	PO3	P04	P05	P06	P07	PO8	60d	PO10	P011	PO12	PS01	PS02
CO1	3	2												
CO2	3	1	1											



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CO3	3	1	1	1					
CO4	3	2	1	1					

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Numerical Methods for Scientific and Engineering Computations	M K Jain, S R K Iyengar and R K Jain,	New Age International, 2004.
2	Higher Engineering Mathematics	B S Grewal	41 st Edition, Khanna Publishers, 2011.

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Numerical Solution of Differential Equations	M K Jain	2 nd Edition, New Age International, 2008
2	Linear Algebra and its Applications	David C.Lay, Steven R. Lay and J.J.McDonald	5th Edition, Pearson Education Ltd., 2015



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DEPARTMENT OF MECHANICAL ENGINEERING



	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025						
I Seme	I Semester: M.Tech (TPE)						
Sub.C	Code: 24 TPE 12	ADVANCED POW	ER PLANT CYCLES	L-T-P-C: 4-0-	0-4		
Course	ourse Objectives:						
1	To understand the various power plant cycle and their working principles.						
2	To study the wor	king principles of dif	ferent components of pov	ver plant.			
3	To understand co	oncepts of power gen	eration by nuclear power	plant.			
4	To study the con	cept of gas turbine pl	ant.				
Course	e Outcomes:						
CO1	Distinguish the v	arious power plant cy	cle and their working pr	inciples.			
CO2	Describe the wor	king principles of dif	ferent components of pov	ver plant.			
CO3	Explain the conc	epts of power genera	tion by nuclear power pla	int.			
CO4							
Unit	it Description H				Hours		
I	Analysis of Steam Cycle: carnot cycle, limitations of carnot cycle, Rankine				10		
	Cycle – performa	nce – thermodynami	c analysis of cycles, cycle	improvements-			
	0 0		n feed water heating, fee	d water heaters,			
		steam power plant. N	-		10		
II	Gas Turbine Cycles: optimization – thermodynamic analysis of cycles – cycle improvements– multi spool arrangement. Intercoolers, re-heaters,				10		
		-	ance – layouts, numerical				
III	_		n : Flaws of steam as v	- C	10		
			working fluid for vapo es, combined cycle plan	-			
	I		of combined cycle po				
	(Except numeric	_		8			
IV	Overview of Nu	clear Power Plants	: Principles of release of	nuclear energy	12		
	fusion and fissio	n reactions. Nuclear	fuels used in the reactor	s. Multiplication			
			nents of the nuclear read				
			description of reactors	_			
			ooiling water reactor s				
		_	geneous graphite reactor s, Radioactive waste dispo	_			
	reactor, Natiralio	ii iiazai us, siiieiuilig s	s, nautoactive waste dispo	ısaı.			



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V	Economics of power generation : Choice of site for power station, load	10		
	estimation, load duration curve, load factor, capacity factor, use factor,			
	diversity factor, demand factor effect of variable of variable load an power			
	plant, selection of the number and size of units. Cost of energy production.			
	Selection of plant and generating equipment, performance and operating			
	characteristics of power plants, tariffs for electrical energy			

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Power Plant Engineering	P.K. Nag,	Tata McGraw-Hill Publications			
2	Power Plant Engineering	M.M. EI-Wakil	McGraw- Hill Publications			
3	Power plant engineering	R K Rajput	Lakshmi publication			



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	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025	5				
I Seme	ester: M.Tech (TPE)					
Sub.0	Code: 24 TPE 13 ADVANCED FLUID MECHANICS	L-T-P-C: 4-0-	0-4			
Course	Course Objectives:					
1	To study the concepts fluid flow and their governing equations	To study the concepts fluid flow and their governing equations				
2	To understand the concepts in the analysis of fluid flow problems. Turbulent flows	s in laminar and				
3	Adequate exposure to learn formulate and solve one dimensional compressible fluid flow problems					
4	To analyze one dimensional incompressible and compressible flu	uid flow Problem	ıs			
Course	e Outcomes:					
CO1	Basic concepts fluid flow and their governing equations					
CO2	Understand the concepts in the analysis of fluid flow problems in laminar and Turbulent flows					
CO3	Formulate and solve one dimensional incompressible and compressible fluid flow problems					
CO4	Analyze one dimensional incompressible and compressible fluid	flow Problems				
TT	D. a saide de la constantina		TT			
Unit	Description		Hours			
I	Introduction and Kinematics of Fluids : Regimes in mechanics properties, Fluid statics – equilibrium of a fluid element, manometry, Problems. Equations of Fluid Flow : Integral for transport theorem, Conservation equations for mass, momentum integral forms, Problems.	application to orm: Reynolds	14			
II	Governing Equations for Fluid Flow: Differential form: Conservation equations for mass, momentum and energy - differential forms, Euler's equations of motion, integration along the stream line; integration of steady irrotational motion; integration for two dimensional unsteady flow, Problems. Inviscid Incompressible Flows (Potential Flows): Elementary Plane-flow solutions - uniform flow, source and sink flow, Superposition of plane flow solutions - Rankine half-body, doublet, flow past a circular cylinder with circulation, Aerofoil theory.					
III	Exact solutions of N-S Equations and Mechanics of La Introduction; Laminar and turbulent flows; viscous flow at diffe number -; laminar plane Poiseuille flow; stokes flow; flow through	erent Reynolds	06			



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	annulus, Problems.			
IV	Boundary Layer Theory: Introduction; Boundary layer equations; displacement and momentum thickness, shape factor; flow over a flat plate – similarity transformation, integral equation for momentum and energy; skin friction coefficient and; separation of boundary layer; critical Reynolds number; control of boundary layer separation, Problems.	07		
v	Mechanics of Turbulent Flow: structure and origin of turbulent flow - Reynolds, average concept, Reynolds equation of motion; zero equation model for fully turbulent flows; k-E and other turbulence models; turbulent flow through pipes; losses in bends, valves etc; analysis of pipe network - Hard cross method, Problems.			
	Compressible Flows: The speed of sound, Adiabatic and isentropic steady flow, Isentropic flow with area changes, The normal shock wave, Operation of converging and diverging nozzles, Prandtl-Meyer expansion waves. Problems.			

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Foundations of fluid mechanics	S.W. Yuan	Prentice Hall of India, 1976			
2	Fluid Mechanics	F.M. White	McGraw-Hill publications, 2007			



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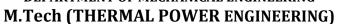


	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025						
I Seme	I Semester: M.Tech (TPE)						
Sub.Co	ode: 24 TPE 14	COMBUSTION ENGINEERING SCIENCE	L-T-P-C: 3-0-	0-3			
Course	Objectives:						
1	To understand	To understand the basic thermodynamic concepts for combustion phenomena					
2	To apply the co	ncept of flam flow mechanism in combustion pro	ocess.				
3	To acquire know devices.	wledge of adiabatic flame temperature in the des	sign of combustio	n			
4	To study pheno	menon of flame stabilization in laminar and turb	oulent flames				
Course	Outcomes:						
CO1	Understand the	basic thermodynamic concepts for combustion	phenomena				
CO2	Apply the conce	pt of flam flow mechanism in combustion proce	SS.				
CO3	Knowledge of a	diabatic flame temperature in the design of com	bustion devices.				
CO4	Identify the phe	nomenon of flame stabilization in laminar and t	urbulent flames				
	1						
Unit	Description H						
I	-			08			
II	Energy balance	Thermodynamics of Combustion: Combustion Process and the first law, Energy balance of chemical reaction, adiabatic flame temperature, Equilibrium Composition of gaseous mixture, Calculation of equilibrium composition and					
	Laminar flame propagation and burning velocity: Premixed flames, Structure of laminar flame and their theories of laminar flame propagation, Methods of observing flame front and measuring burning velocity, Factors affecting burning velocity.						
III	Turbulent fla	Turbulent flame propagation, Flame stability and Diffusion flames Turbulent flame propagation:-Turbulent burning velocity, Factors affect					
	turbulent burning velocity, Structure and theories of turbulent flame, Flame stability, Diffusion flames flame stabilization of open burner, Characteristics stability diagram and Mechanisms of flame stabilization, flame stretch theories and flame stabilization by eddies, theories of diffusion flames						



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IV	Combustion of liquid and solid fuels - Combustion of liquid fuels and fuel droplets, Shape of flame surface during burning of droplet with natural convection, droplet interference during burning, diffusion of flame in spray combustion, combustion of coal, burning time of fuel particles.	80
V	Combustion Application: Coal burning equipment, Pulverized Coal burners, Cyclone Burners oil and gas burners, Combustion in IC engine, Rocket engines, gas turbine and jet engines	08

Reference Books:					
Title	Author	Volume and Year of Edition			
Fuels and combustion	S.P. Sharma and Chandra Mohan	Tata McGraw-Hill, 1984.			
Energy. Combustion and Environment	N.A. Chigier	McGraw-Hill, 1981			



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	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025				
I Seme	I Semester: M.Tech (TPE)				
Sub.Co	Sub.Code: 24 TPE LB1 THERMAL ENGINEERING LABORATORY L-T-P-C: 0-0-3-1.5				
Course	e Objectives:				
1	To able to identify and select the equipment to conduct the experiments related to heat engine lab				
2	To able to demons	trate the procedure for conduction of experi	ments.		
3	to heat transfer la		eriments related		
4	To analyze the dat	a collected and interpret the results.			
Course	e Outcomes:				
CO1	Identify and select the equipment to conduct the experiments related to heat engine lab				
CO2	Demonstrate the procedure for conduction of experiments.				
CO3	Identify and select the equipment to conduct the experiments related to heat transfer lab				
CO4	Analyze the data collected and interpret the results.				
Expt.	Description				
1.	Performance testing of 4-stroke Diesel engine with a rope brake dynamometer. Determination of BP, IP, mechanical efficiency, brake and indicated thermal efficiencies, and brake and indicated specific fuel consumption.		•		
2.	Heat balance shee	t preparation for a 4-stroke Diesel engine.			
3.	Combustion characteristics of a 4-stroke Diesel engine. Determination of mass fraction burnt heat release rate, overall combustion duration, and ignition delay period from P-Theta diagram				
4.	Performance testing of 4-stroke petrol engine with a rope brake dynamometer. Determination of BP, IP, mechanical efficiency, thermal efficiencies, and specific fuel consumption.				
5.	Heat balance shee	t preparation for a 4-stroke Diesel engine			
6.	Combustion characteristics of a 4-stroke Diesel engine. Determination of mass fraction burnt, heat release rate, overall combustion duration, and ignition delay period from P-Theta diagram				



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7.	Determination of COP for vapor compression refrigeration.
8.	Determination of natural convection heat transfer coefficient for a hollow vertical pipe.
9.	Determination of forced convection heat transfer coefficient for air flow through a horizontal pipe.
10.	Determination of Stefan-Boltzmann constant for radiation heat transfer.
11.	Determination of emissivity of a gray body.



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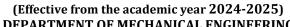
M.Tech (THERMAL POWER ENGINEERING)

PROFESSIONAL ELECTIVE-I

IS	I Semester: M.Tech (TPE)-Professional Elective			
Pr	Professional Elective-I			
1	24TPE151 Energy Conservation and Management			
2	24TPE152	Thermal Power Station		
3	24TPE153	Modeling & Simulation of Thermal Systems		



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	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025		
I Seme	ester: M.Tech (TPE)		
Sub.Co	ode: 24TPE151 Energy Conservation and Management L-T-P-	·C: 3-0-0-3	
Course	se Objectives:		
1	To able to understand the various energy conservation and improvement tec	chniques.	
2	To able to illustrate the Energy scenario.		
3	To study the principles of energy management to improve the Performance of	of systems.	
4	To able to Assess energy projects on the basis of economic and financial crite	eria.	
Course	e Outcomes:		
CO1	Understand the various energy conservation and improvement techniques.		
CO2	Illustrate the Energy scenario.		
CO3	Employ the principles of energy management to improve the Performance of	f systems.	
CO4	Assess energy projects on the basis of economic and financial criteria.		
Unit	Description Hours		
I	Energy Management Principle: General energy problem, Energy uses pat	terns 12	
	and scope of conversion. Need, Organizing and managing an energy manage	ment	
	Energy Auditing and Economic Analysis: Elements and concepts, Type of energy audits instruments used in energy auditing. Cash flows, Time value of		
	money, Formulae relating present and future cash flows- single amount, uniform series.		
II	Financial appraisal methods: Pay back periods, net present value, and be cost ratio, internal rate of return and Life cycle cost / benefits. Thermodyna of energy conservation: Energy conservation in Boilers and furnace, Enconservation in stream and condensate system.	ımics	
III	Cogeneration Concepts: Types & evaluation of a cogeneration system		
IV	Waste Heat Recovery: Potential, benefit, waste heat recovery equipments. So Heating, Ventilation Air Conditioning (HVAC) and water heating of build Transfer of heat, space heating methods, Ventilation and air conditioning, pumps, Insulation, Cooling load, Electric water heating systems, Electric enconversation methods.	lding, Heat	
V	Industrial Insulation: Insulation materials, insulation selection, Econo thickness of insulation. Industrial Heating: Heating by indirect resistance,		



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resistance heating (salt bath furnace), Heat treatment by induction heating in the electric furnace industry. Energy conservation in Electric Utility and Industry: Energy cost and two -part tariff, Energy conservation in utility by improving load factor, Load curve analysis, Energy efficient motors, Energy conservation in illuminating system, Importance of power factor in energy conservation - Power factor and Improvement

Reference Books:				
Title	Author	Volume and Year of Edition		
Electrical Energy Utilization and Conservation	S.C. Tripathy	Tata McGraw-Hill, 1981.		
Energy management handbook	Wayne C. Turner	CRC Press Publications, 2004.		
Industrial Energy Conversation	D.A. Reay	Pergamon Press		



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	SYLLABUS FOR THE ACADEMIC YEAR – 2024 - 2025				
I Seme	Semester: M.Tech (TPE)				
Sub.Co	.Code: 24TPE152 THERMAL POWER STATION L-T-P-C: 3-0-0-3				
Course	Objectives:				
1	To study the working principle, operation and maintenance of a various steam generators	s.			
2	To able to identify the arrangements of different flow systems their operation and mainte	enance.			
3	Γο able to illustrate the impact of thermal power plant exhaust on environment.				
4	To able to estimate the working expenses, current scenario and trends in power generation	on			
Course	Outcomes:				
CO1	Describe the working principle, operation and maintenance of a various steam generators	•			
CO2	Identify the arrangements of different flow systems their operation and maintenance.				
CO3	Illustrate the impact of thermal power plant exhaust on environment.				
CO4	Estimate the working expenses, current scenario and trends in power generation				
Unit	Description Hours				
I	Steam Generator and Auxiliaries: High pressure boilers, classification, schemes, circulation, nature of fuels and its influence on design, furnaces, PF burners, PF milling plant, oil and gas burner types and location, arrangement of oil handling plant.				
II	Waste heat recovery systems: Furnace circuit, steam side and waterside corrosion, pressure parts, super heater, re-heater, and economizer, de-super heater, air heater, on-load cleaning of boilers'				
III	Dust Extraction Equipment: Bag house, electrostatic precipitator, draught systems, FD, ID and PA fans, chimneys, flue and ducts, dampers, thermal insulation and line tracing, FBC boilers and types., waste heat recovery boilers. Feed Water system: Impurities in water and its effects, feed and boiler water corrosion, quality of feed water, boiler drum water treatment and steam purity, water treatment, clarification, demineralization, evaporation and reverse osmosis plant.				
IV	Circulating water system: Introduction, System classification, the circulation system, Wet-Cooling towers, Wet-cooling tower calculations, Dry cooling towers, Dry-cooling towers and plant efficiency and economics, wet-dry cooling towers, cooling-tower icing, Cooling lakes and ponds, Spray ponds and canals. Operation and Maintenance of Steam Generators and auxiliaries: Pre				



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	commissioning activities, Boiler start up and shut down procedures, emergencies in boiler operation, Maintenance of Steam generator and auxiliaries.	
V	Performance: Boiler efficiency and optimization, coal mill, fans, ESP.	10
	EIA study: Pollutants emitted, particulate matter, SOx and NOx and ground level	
	concentration, basic study of stack sizing.	

Reference Books:			
Title	Author	Volume and Year of Edition	
Power Plant Engineering	P.K. Nag	Tata McGraw-Hill, 1981.	
Power Plant Engineering	M. EI-Wakil	Tata McGraw-Hill	
Power Plant Engineering	R.K.Rajput	Laxmi Publications 3rd edition	



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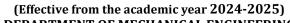
SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE
(Effective from the academic year 2024-2025)
DEPARTMENT OF MECHANICAL ENGINEERING



I Seme	ester: M.Tech (TPE)		
	ode: 24TPE153	MODELING & SIMULATION OF THERMAL SYSTEMS	L-T-P-C: 3-0-	0-3
Course	e Objectives:	-		
1	To study basic prin	nciples and concepts underlying in modeling an	d simulation Tech	niques
2	To able to optimize	e the design of thermal systems.		
3	To able to develop	representational modes of real processes and :	systems	
4	To able to generate	e suitable modelling techniques to compute the	performance	
Course	Outcomes:			
Course	e Outcomes:			
CO1	Explain the basic principles and concepts underlying in modeling and simulation Techniques.			
CO2	Optimize the desig	n of thermal systems.		
CO3	Develop representational modes of real processes and systems			
CO4	Generate suitable	modelling techniques to compute the performa	nce	
	<u> </u>			
Unit	Description Hou		Hours	
I	Principle of Comp	outer Modeling and Simulation: Monte Carlo	simulation,	06
	Nature of compute	er modeling and simulation, limitations of simul	ation, areas of	
	application			
II	_	ronment: components of a system —discrete f a system-a variety of modeling approaches.	and continuous	06
III		Generation: technique for generating random		08
		ne mid product method- constant multiplier ted		
	o .	od —linear congruential method —tests for r	andom numbers	
		-simrnov test-the Chi-square test.	1	
	distribution- unif	e Generation: inversion transform techniq orm distribution-weibul distribution empir rating approximate normal varieties—Erlang o	ical continuous	
IV	_	te Distribution: Discrete uniform distribut letric distribution- acceptance-rejection technica distribution.	-	10
	Design And Eva	lluation Of Simulation Experiments: vari	iance reduction	



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	simulation models.	
V	Discrete Event Simulation : concepts in discrete-event simulation, manual simulation using event scheduling, single channel queue, two server queue simulation of inventory problem. Introduction to GPSS : Programming for discrete event systems in GPSS, case studies.	10

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Discrete event system simulation -	Jerry Banks & John S Carson II,	Prentice Hall Inc, 1984.			
2	Systems simulation	Gordon G	Prentice Hall Of India Ltd,1991.			
3	System simulation with digital Computer	Narsingh Deo	Prentice Hall Of India Ltd,1979			



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)



M.Tech (THERMAL POWER ENGINEERING)



PROFESSIONAL

ELECTIVE-II

Profes	Professional Elective-II		
1	24TPE161	Theory of IC Engines	
2	24TPE162	Refrigeration and Air Conditioning	
3	24TPE163	Experimental Methods in Thermal Power Engineering	



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DEPARTMENT OF MECHANICAL ENGINEERING M.Tech (THERMAL POWER ENGINEERING)

	SYI	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025			
I Seme	Semester: M.Tech (TPE)				
Sub.Co	ode: 24TPE161	THEORY OF IC ENGINES	L-T-P-C: 3-0-	0-3	
Course	e Objectives:				
1	To study different l	Fuel-air and actual cycles.			
2	To able to demonst	rate the different types of injection and carbur	retor systems		
3	To able to formulat	e the flow and combustion phenomenon for m	odeling		
4	To able to identify	the various types of emissions, noise and their	control systems		
Course	e Outcomes:				
CO1		nt Fuel-air and actual cycles.			
CO2	Ü	fferent types of injection and carburetor syste	ms		
CO3		and combustion phenomenon for modeling			
CO4		•	atom a		
LU4	identify the various	s types of emissions, noise and their control sy	stems		
Unit		Description		Hours	
I		d Operating Parameters: Engine characteris		09	
		procating engines, brake torque, indicated values. and efficiency, specific emissions and			
		een performance parameters, Engine design a			
	_	els for I.C engines: Vegetable oils, alcoho	-		
	1 1	n characteristics, F/ A ratio .			
II	Ideal models for engine cycles: Thermodynamic relation for engine process, Ideal Cycle analysis, fuel-air cycle analysis, over expanded engine cycles, Availability analysis of engine processes, comparison with real engine cycle				
	SI Engines fuel metering, manifold phenomena: S.I. Engine mixture requirements, carburetors, fundamentals and design, fuel injection systems, feed back systems, flow past throttle plate, flow in in-take manifold				
III	Combustion in IC Engines: Combustion in SI Engines – Flame front propagation, flame speed, rate of pressure rise, knock in SI engines; combustion in CI engines – ignition delay period, rapid and controlled combustion, factors affecting delay period, knock in CI engines				
IV				06	



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(Effective from the academic year 2024-2025)

DEPARTMENT OF MECHANICAL ENGINEERING



V	Instrumentation: Pressure measurement in engines, recording pressure and				08		
	crank	angle	diagram,	measurement	of	pollutants.	
	Engine	emissions a	nd their contr	ol: Air pollution due	e to IC e	engines, Euro	
		converters, p	•	sion control methods s, Ammonia injection		-	

Reference Books:						
Title	Author	Volume and Year of Edition				
Internal Combustion Engines	V. Ganesan	Tata McGraw-Hill Publications.				
IC Engines fundamentals	John B. Heywood	McGraw-Hill Publications				
Internal Combustion Engines: Applied Thermo sciences	C.R. Fergusan	John Wiley & Sons				



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DEPARTMENT OF MECHANICAL ENGINEERING



	SY	LLABUS FOR THE ACADEMIC YEAR - 2024	- 2025	
I Seme	ester: M.Tech (TPE)			
Sub.Co	ode: 24TPE162	REFRIGERATION AND AIR - CONDITION	ING L-T-P-C: 3-0-	-0-3
Course	e Objectives:		l	
1	To study the concep	ts of refrigeration and air-conditioning proc	cess and systems.	
2	absorption refrigera	ne theoretical principles to simple, complex tion systems.		_
3	To able to understa	nd conventional and alternate refrigerants a	nd their impact on enviro	onment.
4	To able to heat load	calculation to design the air-conditioning s	systems	
Course	e Outcomes:			
CO1	Understand concept	s of refrigeration and air-conditioning proce	ess and systems.	
CO2	Employ the theoretical principles to simple, complex vapour compression and vapour absorption refrigeration systems.			
CO3	Understand conven	tional and alternate refrigerants and their in	npact on environment.	
CO4	Apply the heat load	calculation to design the air-conditioning s	systems	
Unit		Description		Hours
I	refrigeration, evapo by throttling of ga refrigeration by us refrigerants, propert	geration and Non-conventional refrigerative refrigeration, refrigeration by expansists, Vapor refrigeration system, steam jesting liquid using liquid gases, dry icesties of refrigerants, thermoelectric refrigeration.	sion of air, refrigeration t refrigeration system, refrigeration, types of	06
II	Air refrigeration system: Bell Coleman air refrigerator, advantages and disadvantages of air refrigeration system, necessity of cooling the aero plane, factors considered in selecting the refrigeration system for aero plane, simple cooling with simple evaporative type aero plane air conditioning, boot strap and boot strap evaporative type, regenerative type, reduced ambient type, comparison of different systems, actual air conditioning system with control, limitations, merits and comparisons.			
III	p-h diagrams for valuation vapor compression compressors.		versus dry compression, ble evaporators and geration system: Basic-	12



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	lithium bromide absorption refrigeration system, analysis of ammonia refrigeration system, comparison of compression and absorption refrigeration system	
IV	Psychometry: Psychometry and psychometric properties, psychometric relations, psychometric chart, psychometric processes, requirements of comfort air conditioning, comfort chart, design consideration, summer air conditioning system, winter air conditioning.	08
	Cooling load calculations and design of air conditioning system: Different heat sources, conduction heat load, radiation load of sun, occupants load, equipment load, infiltration air load, miscellaneous heat sources, fresh air load, design of air conditioning system, bypass factor consideration, effective sensible heat factor, cooling coils and dehumidifying air washers.	
V	Air conditioning systems: Air conditioning systems central station air conditioning system, unitary air conditioning system, direct air conditioning system, self contained air conditioning units, direct expansion system, all eater system, all air system air water system, arrangement of the components of some air conditioned systems used in practice, factory air conditioning. Refrigeration and air conditioning equipments: Refrigeration equipments-Compressors, condensers and cooling towers, evaporators, expansion devices, electric motors air conditioning equipments- air cleaning and air filters, humidifiers, dehumidifiers from different reputed companies, fans and blower.	08

Refer	ence Books:		
Sl. No	Title	Author	Volume and Year of Edition
1	A Course in refrigeration and Air-Conditioning	Arora and Domkundawar	Danpat Rai & Co Publications.
2	Basic Refrigeration and Air Conditioning	P.N. Ananthanarayanan	McGraw-Hill Publications
3	Refrigeration & Air Conditioning	Manohar Prasad.,	New Age International Publications.



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)



DEPARTMENT OF MECHANICAL ENGINEERING M.Tech (THERMAL POWER ENGINEERING)

	SYI	LABUS FOR THE ACADEMIC YEAR - 2024 - 202	5	
I Seme	ester: M.Tech (TPE)			
Sub.Co	ode: 24TPE163	EXPERIMENTAL METHODS IN THERMAL POWER ENGINEERING	L-T-P-C: 3-0-	0-3
Course	e Objectives:			
1		oncepts of errors in measurements, statistical anal and estimation of uncertainty.	ysis of data, regres	ssion
2	To study the working	g principles in the measurement of field and deriv	ved quantities.	
3	To able to examine s	ensing requirements for measurement of thermo-	-physical properties	s,
4	To understand the ra	diation properties of surfaces, and vibration.		
Course	Outcomes:			
CO1	Understand the concepts of errors in measurements, statistical analysis of data, regression analysis, correlation and estimation of uncertainty.			
CO2	Describe the working principles in the measurement of field and derived quantities.			
CO3	Examine sensing rec	uirements for measurement of thermo-physical p	properties,	
CO4	Understand the rad	iation properties of surfaces, and vibration.		
Unit		Description		Hours
I		c concepts of measurement methods, single	-	06
		space and time. Processing of experimental d		
		alysis. Data Acquisition systems: Fundame	•	
		ransmission, A/D-and D/A converters, Basic estem. Computer interfacing of digital instr		
		s; Digital multiplexes, Data acquisition boar		
	image processing fu		a (2114), 21g.tai	
II	Design and Construction of Experimental facilities: wind tunnel, general test rigs, Test cells for flow visualization and temperature mapping.			06
III		nulation of Measurement System: Lumpe	d analysis, first	08
		order systems: Frequency response and	•	
	calculation. Responsible analysis.	nse of a generalized instrument to random	data input, FFT	
	_	surement: Measurement Design, Constructi thermometers, resistance thermometer wi	-	



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	bridge, Thermo-electric effect, Construction, testing and calibration of thermocouples and thermopiles, Analysis of effect of bead size and shielding on time constant and frequency response, characteristics of thermocouple, pyrometers, radiation thermometers			
IV	Interferometry & Humidity measurement: interferometers, Humidity measurement: Conventional methods, electrical transducers, Dunmox humidity and microprocessor based dew point instrument, Calibration of humidity sensors.	12		
	Flow and Velocity Measurement: industrial flow measuring devices, design, selection and calibration, velocity measurements, pitot tubes, yaw tubes, pitot static tubes; frequency response and time constant calculation. Hot-wire anemometer; 2d/3d flow measurement and turbulence measurement, Laser application in flow measurement, Flow visualization techniques, Combustion photography.			
V	Measurement of Pressure, Force, and Torque: Analysis of liquid manometer, dynamics of variable area and inclined manometer, Pressure transducers, Speed and torque measurement: r speed and torque measurement of rotating system.			
	Air Pollution sampling and measurement; Units for pollution measurement, gas sampling technique s, particulate sampling technique, gas chromatography.			

Refer	Reference Books:						
Sl. No	Title	Author	Volume and Year of Edition				
1	Experimental Methods for Engineers	J.P. Holman	McGraw-Hill Publications.				
2	Mechanical Measurements	Beckwith M.G., Marangoni R.D. and Lienhard J.H.,	Pearson Education.				
3	Measurements systems- Application and Design	E.O. Doebelin, Publications.	Tata McGraw-Hill.				



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE

(Effective from the academic year 2024-2025)

DEPARTMENT OF MECHANICAL ENGINEERING



M.Tech (THERMAL POWER ENGINEERING)

II- Semester



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	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025		
II Sem	ter: M.Tech (TPE)		
Sub.C	de: 24 TPE 21 HEAT TRANSFER L-T-P-C: 4-0	-0-4	
Course	Objectives:		
1	To understand different modes of heat transfer with both physics and the mathematic concept	al	
2	Γο understand the concepts of radiation heat transfer for enclosure analysis.		
3	To study the concepts of Boundary layer.		
4	To study free and forced convection problems in real time applications		
Course	Outcomes:		
CO1	Describe the different modes of heat transfer with both physics and the mathematical	concept.	
CO2	Jse the concepts of radiation heat transfer for enclosure analysis.		
CO3	Explain the concepts of Boundary layer.		
CO4	Describe the free and forced convection problems in real time applications		
TT		Hours	
Unit	•		
I	ntroduction and one-dimensional heat transfer: The modes of heat ransfer, the laws of heat transfer, problems Heat conduction in solids: Simple steady state problems in heat conduction, concept of thermal resistance, the critical radius problem, the differential equation of heat conduction, heat generation.	10	
II	Extended surfaces - Fins, other techniques for solving heat conduction problems. Transient heat conduction: unsteady state processes and Transient heat conduction, problems.	12	
III	Heat transfer by forced convection: The differential equation of heat convection, laminar flow heat transfer in circular pipe, turbulent flow heat ransfer in a pipe, the thermal boundary layer, heat transfer in laminar flow over a flat plate, the integral method, analogy between heat and momentum ransfer, heat transfer in turbulent flow over a flat plate, flow across a cylinder, low across a bank of tubes, problems. Heat transfer by natural convection: Natural convection heat transfer from a vertical plate, correlations for a horizontal cylinder and a horizontal plate, correlations for enclosed spaces, problems.	12	
IV	Heat exchangers: Types of heat exchangers, direct transfer type of heat	10	



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)



DEPARTMENT OF MECHANICAL ENGINEERING M.Tech (THERMAL POWER ENGINEERING)

	exchangers, classification according to flow arrangement, fouling factor, logarithmic mean temperature difference, the effectiveness-NTU method Compact heat exchangers.	
	Condensation and boiling: Film and drop condensation, film condensation on a vertical plate, condensation on horizontal tubes, bank of tubes, effect of superheated vapor and of non-condensable gases, types of boiling: correlations in pool boiling heat transfer, forced convection boiling, problems.	
V	Thermal radiation: Basic concepts, emission characteristics and laws of black body radiation, radiation incident on a surface, solid angle and radiation intensity, heat exchange by radiation between two black surface elements, heat exchange by radiation between two finite black surfaces, radiant heat exchange in an enclosure having black surfaces, heat exchange by radiation between two finite parallel diffuse-gray surfaces, heat exchange by radiation in an annular space between two infinitely long concentric cylinders, radiant heat exchange in an enclosure having diffuse gray surfaces, problems.	08

Refer	Reference Books:							
Sl. No	Title	Author	Volume and Year of Edition					
1	Heat Transfer - A Basic Approach	Ozisik M.N	McGraw-Hill Publications.1985					
2	Heat Transfer	J.P. Holman	McGraw-Hill Publications.					
3	Principles of Heat Transfer	Frank Kreith& M. S. Bohn.,	Thomson Publications, 2001					



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	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025			
II Sem	ester: M.Tech (T	PE)		
Sub.C	Sub.Code: 24 TPE 22 TURBOMACHINES L-T-P-C: 4-0			0-4
Course	e Objectives:			
1	To study the wor	king principles of Gas and steam turbines noz	zle and diffusers.	
2	To study the principles of thermodynamic concept to determine the performance o			ance of
3	To able to Illustra	ate the concepts of flow over the Impulse-Rea	ction Turbine Blac	les.
4	To study the Jet a	nd Rocket Propulsion		
Course	Outcomes:			
CO1	Describe the working principles of Gas and steam turbines nozzle and diffusers.			
CO2	Explain the principles of thermodynamic concept to determine the performance o steam and gas turbines.			ance of
CO3	Illustrate the concepts of flow over the Impulse-Reaction Turbine Blades.			
CO4	Explain Jet and Rocket Propulsion			
Unit	Description I			Hours
I	Nozzles and diffusers: Introduction types of nozzles, types of Diffusers, Equation of Continuity Sonic Velocity and Mach Numbers, The Steady Flow Energy Equation in Nozzles, Gas Nozzles The Momentum Equation for the flow Through Steam Nozzles, Entropy Changes with friction, Nozzle Efficiency, The Effect of Friction on the Velocity of steam Leaving the Nozzles, Diffusion Efficiency, shape of Nozzle for Uniform Pressure Drop, Mass of Discharge of Critical Pressure in Nozzle Flow or Chocked Flow, Physical Explanation of Critical Pressure, Maximum Discharge of Saturated Steam, Maximum Discharge of Steam initially Superheated, Critical Pressure Ratio for Adiabatic and Frictionless Expansion of Steam from Ratio for Adiabatic and Frictionless Expansion of Steam from a given initial Velocity, Total or Stagnation Enthalpy and Pressure, General Relationship Between or Area Velocity and pressure in Nozzle Flow.		12	
II	Steam Turbines Types: Principal of operation of turbine, Comparison of Steam Engines and Turbines, Classifications of Steam Turbine, The Simple Impulse Turbine, Compounding of Impulse Turbine, Pressure Compounded		12	



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	Impels Turbine, Simple Velocity –Compounded Impulse Turbine, Pressure Velocity –Compounded Impulse Turbine, Impulse –Reaction Turbine, Combination Turbines, Difference between Impulse and Reaction Turbines. Flow of Steam through Impulse Turbine Blades: Velocity Diagram for Impulse Turbines, Combination of Vector Diagram, Forces on the Blade and Work done by Blades, Blade or Diagram Efficiency, Axial Thrust or end thrust on the rotor, Gross Stage Efficiency, Energy Converted heat by blade friction, Influence of ratio of blade speed to steam speed on blade efficiency in single stage impulse turbine, Efficiency of multistage impulse turbine with single row wheel, Velocity diagram for three row velocity compound wheel, Most economical ratio of blade speed for a two row velocity compounded impulse wheel, Impulse blade suctions, Choice of blade angle, Inlet blade angles, Blade heights in velocity compounded impulse turbine.	
III	Flow of Steam Through Impulse-Reaction Turbine Blades: Velocity diagram, degree of reaction, impulse- reaction turbine with similar blade section and half degree reaction turbine, height of reaction turbine blading, effect of working steam on the stage efficiency of Parson's turbine, operation of impulse blaring with varying heat drop or variable speed, impulse- reaction turbine section.	08
IV	State Point Locus Reheat Factor and Design Procedure: Introduction, stage efficiency of impulse turbines, state point locus of an impulse turbine, reheat factor, internal and other efficiencies, increase in isentropic heat drop in a stage due to friction in proceeding stage, correction for terminal velocity, reheat factor for an expansion with the uniform adiabatic index and a constant stage efficiency, correction of reheat factor for finite number of stages, design procedure of impulse turbine, design procedure for impulse- reaction turbines.	
V	Jet and Rocket Propulsion : The ram jet engine, pulse jet engine, turbo prop engine, turbo jet engine, thrust equation, specific thrust, principles of rocket propulsion, ideal chemical rocket, advantages of liquid over solid propellants, free radical propulsion, nuclear propulsion, electro dynamics propulsion, photon propulsion.	12



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE





Reference Books:				
Sl. No	Title	Author	Volume and Year of Edition	
1	Steam and Gas Turbines	R. Yadav,	Central Publishing House, Allahabad	
2	Gas Turbine Theory	H.I.H. Saravanamuttoo,	G.F.C. Rogers & H Cohen Pearson Education.	
3	Gas Turbines	V. Ganesan,	Tata McGraw-Hill Publications	



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE

(Effective from the academic year 2024-2025)

DEPARTMENT OF MECHANICAL ENGINEERING

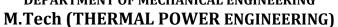


	SY	/LLABUS FOR THE ACADEMIC YEAR - 2024 - 2025	
II Sem	ester: M.Tech (Tl	PE)	
Sub.0	Code: 24 TPE 23	FINITE ELEMENT METHODS L-T-P-C: 4-0-	-0-4
Course	e Objectives:		
1	To able to establis the nature of solut	sh the mathematical models for the complex analysis problems and tion.	predict
2	To able to formulate the element characteristic for linear and nonlinear matrices and vectors.		
3	To able to identify the boundary conditions and their incorporation in to the FE equations.		
4	To able to solve the problems with simple geometries, with hand calculations involving the fundamental concepts.		
Course	e Outcomes:		
CO1	Establish the mathematical models for the complex analysis problems and predict the nature of solution.		
CO2	Formulate the element characteristic for linear and nonlinear matrices and vectors.		
CO3	Identify the boundary conditions and their incorporation in to the FE equations.		
CO4	Solve the problems with simple geometries, with hand calculations involving the fundamental concepts.		
Unit	Description Hour		
I	Introduction: Introduction to FEM, Basic Steps, Applications in various areas of Engineering, Advantages, Limitations, Need for FEM, Structure of FEM Package. Basics of theory of elasticity Equations of equilibrium, stress-strain relations for 2-d and 3-d, Plane stress, strain and axis symmetric cases. Potential energy, Principle of minimum potential energy, Applications to solve simple spring systems. Raleigh Ritz method:- Steps, uses, limitations, applications on simple cases on bars and beams to find displacement equations, Galerkin Approach:- Weighted residual method.		12
II	scheme, coordinat Finite element conditions using 6	l Finite element analysis: Finite element modeling, Numbering te system, shape functions, Element stiffness matrix & load vector, equations- Elimination approach Applications of boundary elimination and, penalty methods. Application problems – 1-d bar Expansion problems.	12



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III	Trusses : Plane trusses, local & global coordinate systems, element stiffness matrix, stress calculations. Thermal Expansion problems	
	FEM for 2-D Problems: Shape functions, stiffness matrix, strain matrix, load vectors for CST Elements and application problems.	
IV	1-D Steady state heat conduction : Governing equation, boundary conditions, 1-D element, for heat conduction & Convection, 1-D heat transfer in fin & Problems, Problems on composite walls, Heat generating Plates.	80
V	Fluid Flow:- Flow through Porous medium, Fluid flow in pipes and around solid bodies in 1D.Shape function, Stiffness matrix. Convergence criteria, Pascal triangle, Patch Test, Lagrangian Shape function.	08

Sl. No	Title	Author	Volume and Year of Edition
1	Introduction to Finite Elements in Engineering	Tirupathi R Chandrupatla	Pearson; 4th edition, 20 December 2011
2	Finite element Method	S B Halesh	Sapna Book House, Revised and enlarged edition, 2019
3	Introduction to Finite Element Analysis and Design	Bhavani V. Sankar	Wiley; 2nd edition (August 20, 2018)



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE



(Effective from the academic year 2024-2025) DEPARTMENT OF MECHANICAL ENGINEERING

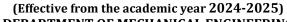
M.Tech (THERMAL POWER ENGINEERING)

SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025				
II Sem	ester: M.Tech (TI	PE)		
Sub.Co	ode: 24 TPE 24	Advanced Design of Heat Transfer Equipments	L-T-P-C: 3-0-	0-3
Course	e Objectives:			
1		LMTD and Effectiveness methods in the design the LMTD approach over AMTD app		gers
2	To able to examinexchangers.	e the performance of double-pipe counter flo	w (hair-pin) heat	
3	To able to design	and analyze the shell and tube heat exchange	r.	
4	To understand th condensation.	e fundamental, physical and mathematical asp	oects of boiling an	d
Course	e Outcomes:			
CO1		d Effectiveness methods in the design of heat fLMTD approach over AMTD approach.	exchangers and a	nalyze
CO2	Examine the perf	ormance of double-pipe counter flow (hair-pi	n) heat exchanger	S.
CO3	Design and analyze the shell and tube heat exchanger.			
CO4	Understand the f condensation.	ındamental, physical and mathematical aspec	ts of boiling and	
Unit		Description		Hours
I	factors, Calorific	at Exchanger: Film coefficient for fluids in temperature, Average fluid temperature, Th anger, Double pipe exchangers in series parall ems	ne calculation of	08
II	exchangers, Calc coefficients, She temperature diff Analysis of perf Optimum Outlet water temperaturuse of Exhaust	leat Exchangers: Tube layouts for exchangers, ulation of shell and tube heat exchangers, ell side Mass Velocity equivalent diameterence in a 1-2 heat exchanger, Shell side formance of 1-2 heat exchanger, Exchanger-water temperature, Solution Exchanger, Gre, Solution Exchanger, Steam as Heating Meand Process steam, 1-2 exchangers without exchangers. Efficiency of exchanger, Influence	Shell side film eter, The true e pressure drop er using Water, Optimum Outlet edium, Optmium out baffles, Heat	10



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE





	temperature on correction factor., Tube side pressure drop, Flow Arrangements For Increased Heat Recovery: The calculation of 2-4 exchangers Numerical Problems	
III	Condensation of Single Vapors: Condensation on surface-Nusselt theory Condensation between horizontal and Vertical condenser, Condensation inside tubes, Partial Condenser and the Balanced Pressure drop, Influence of Impurities, Vertical condenser-sub-Cooler, Horizontal Condenser-Sub cooler, Vertical reflux type condenser, Condensation of Steam, Numerical Problems.	06
IV	Vaporizers, Evaporators and Reboilers: Vaporizing processes. Forced and Natural circulation Vaporizer, Reboiler arrangement, Classification of Vaporizing exchanger, Relation between Maximum flux and Maximum film coefficient, Forced circulation vaporizing exchangers, Natural Circulation vaporizing exchangers, Recirculation ratios, reboiler heat balance, temperature potentials in distillations, thermal condition of the feed effect upon the reboiler, Reboiler duty for multi-component mixture,	08
V	Cooling towers:- Diffusion theory, Relation between wet bulb & dew point temperatures, The Lewis number, effective film, Humdification and dehumidification, Classification of cooling towers, Cooling tower internals and the roll of fill, Heat Balance, Heat Transfer by simultaneous diffusion and convection, Analysis of cooling tower requirements, Determination of the number of diffusion units, Correction for the liquid film resistance, Cooling tower process conditions, Humidification coefficients, Calculation of cooling tower performance. Influence of process conditions upon design, Influence of operating variables, dehumidifiers, Heat transfer from gases, Calculation without a simplified Lewis number, sensible Heat transfer	08

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Process heat transfer	Donald Q .Kern	Tata McGraw Hill Publishing Company Ltd			
2	Chemical Process Equipment: selection and design	James R. Couper; W. Roy Penney, James R. Fair, Stanley M. Walas	Elsevier Inc., 2nd ed. 2005.			
3	Process Heat Transfer	Sarit K.Das.,	Narosa Publishing House Pvt. Ltd.			



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	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025					
II Sem	ester: M.Tech (TI	PE)				
Sub.Co	D.Code: 24 TPE LB2 CAE LABORATORY L-T-P-C: 0-0-3-1.5					
Course	Objectives:					
	To understand th	e Stress concentration on the objects				
		e boundary Condition for Convection				
		e boundary Condition for Radiation				
		e Fluid Flow of Parallel/Counter Flow I	Heat Exchanger			
Course	Outcomes:					
		tress concentration on the objects				
		oundary Condition for Convection				
		oundary Condition for Radiation				
	Understand the F	luid Flow of Parallel/Counter Flow Hea	nt Exchanger			
Expt.		Description				
1.	Determination of	deflections and stresses in a perfect fra	nme.			
2.	Determination of the center	stress concentration factor for a flat	plate with a circular cutout at			
3.	Temperature Dis	tribution in a simple Parallel/Counter F	Flow Heat Exchanger			
4.	Analysis of Wate Heat Transfer	r Cooled Wall Temperature with comb	ined Radiation and Convection			
5.	Analysis of Ball in	a Box with Body to Body Radiation				
6.	Analysis of Parall	el/Counter Flow Heat Exchanger with I	Fluid Flow			
7.	Analysis of Cylind	ler with Convection				
8.	Analysis of 2D Cy	linder with wake Vortex				



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE
(Effective from the academic year 2024-2025)
DEPARTMENT OF MECHANICAL ENGINEERING
M.Tech (THERMAL POWER ENGINEERING)

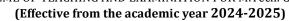


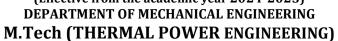
PROFESSIONAL ELECTIVE-III

Professional Elective-III			
1	24TPE251	Alternate Fuels for IC Engine	
2	24TPE252	Computational Fluid Dynamics	
3	24TPE253	Convective heat transfer	



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CHOICE BASED CREDIT SYSTEM (CBCS)







	SYI	LABUS FOR THE ACADEMIC YEAR - 2024 - 202	5		
II Sem	ester: M.Tech (TPE)			
Sub.Co	D.Code: 24TPE251 ALTERNATIVE FUELS FOR IC ENGINES L-T-P-C: 3-0-0-3				
Course	e Objectives:				
1	To able to Interpre	the suitable alternative fuels like CNG and LN	IG		
2	To study the charact	eristics of alcohols in SI & CI engines.			
3	To able to analyze to	ne various gaseous alternative fuels for IC engine	e applications		
4	To study the various	properties of bio fuels and their significance in l	IC engines		
Course	Outcomes:				
CO1	Interpret the suitab	ole alternative fuels like CNG and LNG			
CO2	Explain the characte	ristics of alcohols in SI & CI engines.			
CO3	Analyze the various	gaseous alternative fuels for IC engine application	ons		
CO4	Determine various properties of bio fuels and their significance in IC engines				
	1				
Unit		Description		Hours	
I	refining process, Finumber requireme		ine fuels, Octane	12	
	Properties of petroleum products: Specific gravity, Density, Molecular weight, Vapour pressure, Viscosity, Flash point, Fire point, Cloud point, Pour point, Freezing point, Smoke point & Char value, Aniline point, Octane Number, Performance Number, Cetane Number, Emulsification, Oxidation Stability, Acid Value/Number, Distillation Range, and Sulphur content.				
II				04	
III	engines, Engine characteristics of a Dual fuel Engine : dual fuel engines, alcohols, LPG, CNG mode. Engine mod	es: Properties of alternative fuels, Use of alter modifications required, Performance Iternative fuels in SI mode of operation v/s ga Need and advantages, The working principle Factors affecting combustion in dual fuel Hydrogen, Biogas and Producer gas in CI engifications required. Performance and emissio (mentioned above) in Dual Fuel mode of ope	and emission soline operation. e, Combustion in engine, Use of gines in dual fuel on characteristics	12	



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE



M.Tech (THERMAL POWER ENGINEERING)



IV	Bio-diesels : What are bio-diesels Need of bio-diesels, Properties of bio-diesels v/s petro-diesel, Performance and emission characteristics of bio-diesels v/s Petro diesel operation.		
V	Availability: Suitability & Future prospects of these gaseous fuels in Indian context. Environmental pollution: with conventional and alternate fuels, Pollution control methods and packages	06	

Refer	Reference Books:				
Sl No	Text Book title	Author	Volume and Year of Edition		
1	A Course in Internal Combustion Engines	R.P Sharma & M.L. Mathur,	Danpat Rai & Sons.		
2	Elements of Fuels, Furnaces & Refractories	O.P. Gupta,	Khanna Publishers		
3	Internal Combustion Engines	Domkundwar V.M	I Edition, Dhanpat Rai & Sons		



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)







	SYI	LLABUS FOR THE ACADEMIC YEAR - 2024 - 2025			
II Sem	ester: M.Tech (TPE)			
Sub. Co	Sub. Code: 24TPE252 COMPUTATIONAL FLUID DYNAMICS L-T-P-C: 3-0-0-				
Course	Objectives:				
1	To study the stepw computational met	ise procedure to completely solve a fluid dynamics problem us hods.	ing		
2	To study the govern	ning equations and understand the behavior of the equations.			
3	<u>-</u>	tency, stability and convergence of various discretization schernd hyperbolic partial differential equations.	nes for		
4	-	variations of SIMPLE schemes for incompressible flows and Va	riations		
Course	Outcomes:				
CO1	To derive the stepy computational met	vise procedure to completely solve a fluid dynamics problem us hods.	sing		
CO2	To explain the gove	erning equations and understand the behavior of the equations	,		
CO3	To determine the consistency, stability and convergence of various discretization schem for parabolic, elliptic and hyperbolic partial differential equations.				
CO4	To verify variations of SIMPLE schemes for incompressible flows and Variations of Flo				
Unit		Description	Hours		
I		ions: Review of equations governing fluid flow and heat boundary conditions, partial differential equations, Dirichlet as.			
II	flow modeling, ap	Discretization, consistency, stability and fundamentals of fluid oplication in heat conduction and convection, steady and flow.			
III	Finite volume method: Application to steady state Heat Transfer: Introduction, regular finite volume, discretization techniques, Application to transient Heat Transfer, application to Convective Heat Transfer.				
IV	Finite Volume Me algorithms.	ethod: Application to Computation of Fluid Flow SIMPLE	08		



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE
(Effective from the academic year 2024-2025)
DEPARTMENT OF MECHANICAL ENGINEERING



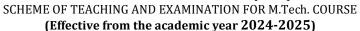
M.Tech (THERMAL POWER ENGINEERING)

V	Solution of viscous incompressible flow: Stream function and vorticity	10
	formulation. Solution of N S equations for incompressible flow using MAC	
	algorithm, Compressible flows via Finite Difference Methods.	

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Numerical Heat Transfer and Fluid Flow	S.V. Patankar, Company.	Hemisphere Publishing			
2	Computational Fluid Dynamics	T.J. Chung, S	Cambridge University Pres			
3	Computational fluid flow and heat transfer	K. Murlidhar and T. Sounderrajan	Narosa Publishing Co			



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CHOICE BASED CREDIT SYSTEM (CBCS)





	SYI	LABUS FOR THE ACADEMIC Y	EAR - 2024 - 202	25		
II Sem	ester: M.Tech (TPE					
Sub.Co	Code: 24TPE253 CONVECTIVE HEAT TRANSFER L-T-P-C: 3-0-0-					
Course	e Objectives:					
1	To able to underst	and the fundamental and ac	dvanced princip	les of forced and	natural	
2	To able to Formula	e and solve convective heat t	ransfer problem	S		
3	To able to relate th from devices.	e principles of convective hea	t transfer to est	imate the heat diss	sipation	
4	To able to estima transfer.	e the energy requirements	for operating	a flow system wi	ith heat	
Course	e Outcomes:					
CO1	Understand the fur heat transfer proce	ndamental and advanced pri	nciples of force	d and natural cor	nvection	
CO2	Formulate and solv	e convective heat transfer pro	blems			
CO3	Relate the principl devices.	es of convective heat transf	er to estimate	the heat dissipation	on from	
CO4	Estimate the energy	requirements for operating	a flow system w	ith heat transfer.		
Unit		Description			Hours	
I	Introduction: Cons	ervation Principles and Fluid St	resses and Flux I	Laws	04	
II		Γhe Differential Equations Cons Of The Boundary Layer, ' Layer.			06	
III		fer and Heat transfer-I: r Flow inside Tubes. Moment oundary layer.			10	



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE
(Effective from the academic year 2024-2025)







IV	Momentum transfer and Heat transfer-II: Momentum transfer and Heat transfer in Turbulent Boundary Layer, Momentum transfer and Heat transfer for Turbulent Flow inside Tubes.				
V	Influence of Temperature: Dependent Fluid Properties, Free-Convection Boundary Layers.				
	Convective Mass Transfer : Basic Definitions and Formulation of a Simplified Theory, Evaluation of The Mass-Transfer Conductance, Examples for application of the Simplified Method.				

Refer	Reference Books:						
Sl. No	Title	Author	Volume and Year of Edition				
1	Convective Heat and Mass Transfer	W.M. Kays	John Wiley, 1996.				
2	Heat Transfer	J.P. Holman	McGraw-Hill Publications. 2022				
3	Principles of Heat Transfer	Frank Kreith& M. S. Bohn.,	Thomson Publications, 2001				



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)





M.Tech (THERMAL POWER ENGINEERING)

PROFESSIONAL ELECTIVE-IV

Profes	Professional Elective-III			
1 24TPE261 Solar Thermal Technologies and applications				
2	24TPE262	Design and Analysis of Thermal Systems		
3	24 TPE263	Engine Flow and Combustion		



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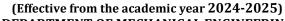


	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025					
II Sem	II Semester: M.Tech (TPE)					
Sub.Co	Sub.Code: 24TPE261 SOLAR THERMAL TECHNOLOGIES AND APPLICATIONS L-T-P-C: 3-0-0-0					
Course	e Objectives:					
1	To able to analyze t	he energy concepts on solar devices for various	us thermal propert	ies.		
2	To able to analyze t	he solar thermal devices for various tracking	modes.			
3	To able to evaluate	the performance of various solar thermal tech	nnologies.			
4	To understand sola	r thermal applications				
Course	e Outcomes:					
CO1	Analyze the energy	concepts on solar devices for various thermal	properties.			
CO2	Analyze the solar th	nermal devices for various tracking modes.				
CO3	Evaluate the perfor	mance of various solar thermal technologies.				
CO4	Understand solar tl	nermal applications				
Unit		Description		Hours		
I	Solar Radiation: Location on earth, celestial sphere, horizon and equatorial system, Instruments for measuring solar radiation and sunshine, description of the various angles depicting the relation between sun and earth, coordinates transformation, solar time, obliquity and declination of the sun, apparent motion of the sun, sun rise and sun set time, east west time, analysis of the direct daily solar radiation on any arbitrarily located surface.		08			
II	Flat Plate Collectors: Performance analysis, transmissivity of the cover system, overall loss coefficient and heat transfer correlations, collector efficiency factor, collector heat removal factor, effects of various parameters on the performance. Evacuated Tube Collectors Principle of working, advantages of ETC over FPC, Types of evacuated tubes. Design aspects of solar plate collectors.					
III	Concentrating collectors: types, description of cylindrical parabolic collector, orientation and tracking modes, performance analysis, parametric study of collector performance in different modes of operation, compound parabolic collector geometry, tracking requirements, parabolic dish collector					
IV	liquid storage tank in	orage: Introduction, sensible heat storage: liquids well mixed condition and thermal stratification, a eat storage, thermo chemical storage.		10		



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE







Applications: Water heating systems (Natural and Forced), Industrial process heating system, Active and passive space heating, Solar absorption refrigeration, Power generation (Low Temperature, Medium Temperature, High Temperature), Distillation, Drying, Cooking, Solar Pond. Recent advancement in materials and systems for thermal energy storage systems.

08

Refer	Reference Books:						
Sl. No	Title	Author	Volume and Year of Edition				
1	Solar Energy-Principles of Thermal Collection & Storage	S.P. Sukhatme,	Tata McGraw-Hill				
2	Solar energy Thermal Process	John A. Duffie &, William A. Bechkam	Wiley-Inter science publication. New York.				
3	Solar Energy - Fundamentals and Application	H.P. Garg & J. Prakash	Tata McGraw-Hill				

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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)

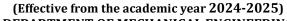


	SYI	LABUS FOR THE ACADEMIC YEAR - 2024 - 202	5	
II Sem	ester: M.Tech (TPE)		
Sub.Co	Sub.Code: 24TPE262 DESIGN & ANALYSIS OF THERMAL SYSTEMS L-T-P-C: 3-0-0-		0-3	
Course	e Objectives:	-		
1	To understand the	physics and the mathematical treatment of typ	oical heat exchange	ers.
2	1 2	MTD and Effectiveness methods in the design ance of LMTD approach over AMTD approach.	of heat exchanger	rs and
3	To able to examine exchangers.	the performance of double-pipe counter flow	(hair-pin) heat	
4	To able to design a	nd analyze the shell and tube heat exchanger.		
Course	e Outcomes:			
CO1	Understand the phy	vsics and the mathematical treatment of typica	l heat exchangers	•
CO2	1 2	Effectiveness methods in the design of heat ex D approach over AMTD approach.	changers and anal	yze the
CO3	Examine the perfor	mance of double-pipe counter flow (hair-pin)	heat exchangers.	
CO4	Design and analyze	Design and analyze the shell and tube heat exchanger.		
Unit		Description		Hours
I	Introduction to Thermal System Design: Introduction; Workable, optimal and nearly optimal design; Thermal system design aspects; concept creation and assessment; Computer aided thermal system design. Thermodynamic modeling and design analysis: First and second law of thermodynamics as applied to systems and control volumes, Entropy generation; Thermodynamic model – Cogeneration system.		08	
II	Energy Analysis: Energy definition, dead state and energy components; Physical Energy – Energy balance; Chemical Energy; Applications of energy analysis; Guidelines for evaluating and improving thermodynamic effectiveness. Heat transfer modeling and design analysis: Objective of heat transfer processes; Review of heat transfer processes involving conduction, convection and radiation and the corresponding heat transfer equations used in the design.			08
III	Hardy – Cross meth	nd pump systems:- Head loss representation od; Generalized Hardy – Cross analysis; Pump ations; Dimensional analysis of pumps; pipir	testing methods;	10



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE





IV	Thermo-economic analysis and evaluation:- Fundamentals of thermo-economics, Thermo-economic variables for component evaluation; thermo-economic evaluation; additional costing considerations.	06
V	Thermo-economic optimization:- Introduction; optimization of heat exchanger networks; analytical and numerical optimization techniques; design optimization for the co-generation system- a case study; thermo-economic optimization of complex systems.	08

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Thermal Design & Optimization	Bejan, A., et al.,	John Wiley, 1996.			
2	Analysis & Design of Thermal Systems	Hodge, B.K.,	2 nd edition, Prentice Hall, 1990.			
3	Design of Thermal Systems	Stoecker, W.F.,	McGraw-Hill.			



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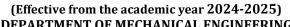
SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE (Effective from the academic year 2024-2025)



	SYLLABUS FOR THE ACADEMIC YEAR - 2024 - 2025				
II Sem	II Semester: M.Tech (TPE)				
Sub.Co	Sub.Code: 24 TPE263 ENGINE FLOW AND COMBUSTION L-T-P-C: 3-0-0-3				
Course	e Objectives:	1			
1	To able to understan	d the concepts of combustion phenomena in energy conversion of	evices		
2	To able to understan	d the concepts of combustion phenomena in energy conversion of	evices.		
3	To able to Analyze t	the implementation limits with regard to performance, emission a	nd		
4		nd understand possible harmful emissions and the legislation star	ndards		
Course	e Outcomes:				
CO1	Understand the conc	epts of combustion phenomena in energy conversion devices			
CO2	Understand the conc	cepts of combustion phenomena in energy conversion devices.			
CO3	Analyze the implem compatibility	entation limits with regard to performance, emission and materia	ls		
CO4	Identify and underst	and possible harmful emissions and the legislation standards			
Unit		Description	Hours		
I	Gas exchange process: Inlet & exhaust processes in four stroke cycle, volumetric efficiency, flow through valves, residual gas fraction, exhaust gas flow rate and temperature variation, super charging, turbo charging.				
II	characteristics, swi	ith in the cylinder: Intake jet flow, mean velocity turbulender, squish, pre chamber engine flows, crevice flow and blow be piston cylinder wall interaction.			
III					
IV		on and control: Nature of the problem, nitrogen oxide, carbo	10		



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	monoxide, un-burnt hydrocarbon emissions, particulate emissions, exhaust gas treatment.	
V	Engine heat transfer: Model of heat transfer, engine energy balance, intake and exhaust heat transfer, radiations from gases, flame radiation component, temperature distributions, effect of engine variables. Super Charging and Engine Performance.	10

Refer	Reference Books:					
Sl. No	Title	Author	Volume and Year of Edition			
1	Internal Combustion Engines	V. Ganesan,	Tata McGraw-Hill			
2	IC Engines fundamentals	John B. Heywood,	McGraw-Hill			
3	Internal Combustion Engines: Applied Thermo sciences	C.R. Fergusan,	John Wiley & Sons.			



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE
(Effective from the academic year 2024-2025)
DEPARTMENT OF MECHANICAL ENGINEERING
M.Tech (THERMAL POWER ENGINEERING)



GUIDELINES FOR PREPARATION OF PROJECT REPORTS

ARRANGEMENT OF CHAPTERS -

- 1. Cover title page -Format enclosed
- 2. Inner title page Same as cover title page
- 3. **Certificate** from guide and head with declaration by the student
- 4. **Certificate** from Company / Firm whether the project work is carried out.

(Not required if done themselves)

- 5. Acknowledge
- 6. List of tables and figures
- 7. **Abbreviations** / operational definitions used
- 8. **Introduction** should include the following:
 - a. Problem definition / statement. This will cover company profile to the topic chosen pertain to the company 5 pages
 - b. Research Objectives (maximum 5) 1 page
 - c. Research Methodology state the basic and secondary research design. If it a simple survey, explain sampling design and questionnaire design, sources of data and techniques of data analysis 3, 4 pages
 - d. Limitations of Project study 1 page

9. Chapter - 1: Literature review

Discuss the theory, concepts, hypotheses, models, etc., underpinning the project work (Project report is an application of the theoretical knowledge in analyzing a real life problem/issue faced by an organization) – 15 pages

10. Chapter - II, III & IV: Findings

This is the longest section of the project report. In this chapter, data collected will be presented and analysed without drawing any inference.

Depending on the volume of the data presented, there could be 3 to 4 chapters in this section. – at least 40 pages



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SCHEME OF TEACHING AND EXAMINATION FOR M.Tech. COURSE

(Effective from the academic year 2024-2025)

DEPARTMENT OF MECHANICAL ENGINEERING



M.Tech (THERMAL POWER ENGINEERING)

11. Chapter V: Summary of Findings

This chapter be a brief statement of analysis already stated in the findings section – 3 pages

12. Chapter VI: Conclusions and suggestions - 3 pages

Total number of pages must be at least 80 but not more than 100.

- 13. **Bibliography:** References like articles, books, websites, etc., used in the project work must be included in this section strictly following the citation style prescribed by the University.
- 14. **Appendix:** This will include printed secondary data (only if it is very critical) and any questionnaire used for the study.