Curriculum Structure
for
Master of Technology
in
Heat Power Engineering
(MTech HP)

(Pattern2024)

With Effect From A.Y. 2024-25

Matoshri Education Society's

Matoshri College of Engineering and Research Centre, Eklahare, Nashik (Autonomous)

NBA and NAAC Accredited, Approved by All India Council for Technical Education, New Delhi, Affiliated to SavitribaiPhule Pune University, College Code: 5177
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Eklahare, Near Odhagaon, off Nashik-Aurangabad Highway, Nashik, Maharashtra 422105

Curriculum Structure for Post Graduate Programmes- MTech&MCA
(Pattern 2024)

Matoshri College of Engineering and Research Centre, Eklahare, Nashik has been granted the academic autonomous status from academic year 2024-25 by University Grant Commission. The Academic autonomous status has been considered as an opportunity for imparting comprehensive education. The academic autonomous status can be utilized to implement the National Education Policy (NEP 2020) effectively. The institute has a prudent plan to incorporate necessary dynamism in academic structure to march towards the vision of the institute and develop the research and skill oriented human resources contributing to the development of the nation.

With a focus on staying at the forefront of educational innovation, the institution diligently prepares curricula that are both dynamic and industry-aligned. This process entails meticulous planning and collaboration to ensure the development of comprehensive programs catering to the evolving needs of students and industries alike.

The highlights of post graduate (PG) programmes Master of Technology (MTech) and Master of Computer Applications (MCA)curriculum structure:

- Every Post Graduate programme is of two years duration with four semesters.
- The curricula have been designed adhering to the NEP guidelines and norms.
- Efforts have been taken to design the curricula which are unambiguous and self-explanatory.
- Students have to earn 84 credits for the award of MTech/MCA degree

Credit Requirement and Eligibility for the PG Programme

Eligibility first year PG admissions will be as per guidelines provided by Admission Regulating Authority of Government of Maharashtraand guidelines of NEP2020.

Examination and Passing

Rules of Passing

- To pass the course, the student has to earn a minimum of 40 percent marks in End Semester exam and 40 percent average marks (In-Semester marks + End-Semester marks) in the exam head.
- Students can earn the credit of the course if he/she passes the course with appropriate grade.
- The student is declared as PASS in the corresponding year if he/she earns the credits of all the courses of the year.
- A student will be awarded the master's degree if he/she earns 84 credits.

Rules of A.T.K.T.

The students who is not detained to appear in examination either in first semester or second semester of First year and, has filled the form of examination is eligible to take admission in second year of PG course.

Exit Point

For those who join 2 year PG programmes, there shall only be one exit point. Students who exit at the end of 1st year shall be awarded a Postgraduate Diploma

This document includes-

Matoshri College of Engineering and Research Centre (Autonomous)
Curriculum for
Master of Technology in Heat Power Engineering (MTech HPE) 2024-25

Table of Contents

Table 1: Total Credits and Total Marks for Master of Technology (MTech)/MCA		
Semester	**Total Credits**	**Total Marks**
I	22	650
II	22	650
III	20	600
IV	20	600
Total	**84**	**2500**

Table 2: Nomenclature for Course Codes

Format for Course Codes-

YY - Year of Course launch

U/P/D- U : Undergraduate **P-** Postgraduate **D-** Doctoral

NN- Branch Code **MM-** Course Number

YY	U/P/D	NN	MM

NN	Post Graduate Programme	NN	Post Graduate Programme
10	MTech Geotechnical Engineering	13	MTech Electrical Power Systems
11	MTech Data Science	14	MTech Heat Power Engineering
12	MTech VLSI and Embedded System	15	Master of Computer Applications (MCA)

Table 3: Examination Headsand AssessmentSchemes				
Exam Head	**Abbreviation**	**In Semester Exam (40% of Total Marks)**		**End Semester Exam (60% of Total Marks)**
		In_Sem_Exam_1 (20%)	**In_Sem_Exam_2 (20%)**	
Theory	**TH**	CAT/CCE based on 20% curriculum	CAT/CCE based on 20% curriculum	Theory examination based on 60% curriculum
Project	**PROJ**	Progress Review I with Demonstration, Presentation, Oral & Report	Progress Review II with Demonstration, Presentation, Oral & Report	Activity, Presentation, Demonstration, Oral & Report as applicable
Internship	**INT**	Progress Review I with Activity, Presentation,Demonstration, Oral & Report as applicable	Progress Review II with Activity, Presentation, Demonstration, Oral & Report as applicable	Activity, Presentation, Demonstration, Oral & Report as applicable
Practical	**PR**	Mid-semester exam based on experiment/ activity performance, demonstration, Presentation, Oral and Journal, Report as applicable		Experiment,activity performance, demonstration, Presentation, Oral & Report, journal as applicable
Term work	**TW**	Mid-semester exam based on experiment/ activity performance, demonstration, Presentation, Oral andJournal, Report as applicable		Activity, Experiment performance, demonstration, Presentation, Oral & Report, journal as applicable
Seminar	**SEMI**	Mid-semester review based on topic of study, literature study, draft of paper manuscript, report(s) and other as applicable		Discussions, Presentation, Report(s), publicationas applicable
Continuous Assessment Test	**CAT**	Class test examination to assess and evaluate a student's progress with descriptive or objective questions as measure of the student's knowledge and skills in online or offline mode.		
Continuous and Comprehensive Evaluation	**CCE**	Examination that evaluate learners' abilities based on various dimensions viz- academic performance, work experience, skills, coordination, agility, innovation, teamwork, public speaking, behavior, and similar as a measure of knowledge, skills and attitude.		

Table 4: Various Courses' Categories, Description and Abbreviation		
Broad Category	**Description**	**Abbreviations**
Program Courses	Programme Core Course	PCC
	Programme Core CourseLaboratory	PCCL
	Programme Elective Course	PEC
	Programme Elective CourseLaboratory	PECL
Multidisciplinary Courses	Multidisciplinary Course	MDC
	Generic Elective	GE
Experiential Learning Courses	Project	PROJ
	Internship / On Job Training	INT / OJT
Course Type/ Teaching Learning Schemes / Examination Heads	Practical	PR
	Internship	INT
	Theory	TH
	Tutorial	TUT
	Lecture	Lect
	Laboratory Course	Lab
	Term work	TW
	Seminar	SEMI
MOOC	Massive Open Online Courses by NPTEL under SWAYAM	MOOC
Project Management, Finance and Governance	Project Planning/ Entrepreneurship Development / Engineering Economics / Management/ Corporate Laws/ Corporate Governance	PMFG
In Semester Examination	In_Sem_Exam	ISE
Continuous Assessment Test	Continuous Assessment Test	CAT
End Semester Examination	End_Sem_Exam	ESE
Continuous & Comprehensive Evaluation	Continuous & Comprehensive Evaluation	CCE
Bloom's Taxonomy	Bloom's Taxonomy	BL
Course Outcome	Course Outcome	CO
Program Outcome	Program Outcome	PO

Table 5: Program Outcomes At the end of Post Graduate Program, a student would have:	
PO1	**Problem Solving and Research Skill:** An ability to independently carry out research /investigation and development work to solve practical problems
PO2	**Communication:** An ability to write and present a substantial technical report/document
PO3	**Lifelong Learning:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
PO4	**Critical Thinking, Project Management and Finance, Skills and knowledge:** Demonstrate advanced knowledge and skills understanding management principle to analyze complex engineering problems critically, and apply the same to, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economic and financial factors while working as individual or in teams or as a leader in a team.
PO5	**Collaborative and Multidisciplinary work:** An ability to think critically and apply appropriate logic, analysis, judgment and decision making and to function as an effective member or leader of engineering teams to achieve common goals.
PO6	**Usage of Modern Tools, Ethical Practices and Social Responsibility:** An ability to use appropriate techniques, skills, and modern engineering tools necessary for engineering practice and commit to professional ethics and responsibilities

Program Specific Outcomes At the end of Post Graduate Program,	
PSO1	**Professional skills** – Apply the knowledge and skills in diverse domains of mechanical engineering.
PSO2	**Problem solving skills** – Identify, formulate, design, investigate and solve engineering problems of thermal, industrial and inter-disciplinary fields by using various engineering tools to meet the needs of the industry with best quality practices.

Preface

This is **Version 2** of the **MTech Heat Power EngineeringCurriculum 2024**. The following changes have been madecompared to Version 1:

1. **Modification in Semester II Course Structure (Table No. 7)** – Inclusion of the course **Human Rights.**
2. **Updated Course Contents** for **Semesters II, III, and IV**.

Matoshri College of Engineering and Research Centre (Autonomous)
Curriculum Structure for Master of Technology(M.Tech) in Heat Power Engineering (Course 2024)
Table No 6: First Year Master of Technology (F.Y. MTech)
Semester I

Courses				Teaching Scheme Hrs/Week			Examination and Marks (% of Total Curriculum and Marks)				Credit			
							In_Sem Exam (40%)		End_Sem Exam (60%)	Marks				
Course Code	Course Type	Title of Course	Exam Head	Lect	TUT	PR	CAT	CCE	ESE	Total	TH	TUT	PR	Total
24P1401	MDC	Advanced Fluid Mechanics	TH	04	-	-	20	20	60	100	04	-	-	04
24P1402	PCC	MOOC-1	TH	04	-	-	20	20	60	100	04	-	-	04
24P1403	PCC	Research Methodology	TH	02	-	-	20	20	60	100	02	-	-	02
24P1404	PCC	Advanced Thermodynamics and Combustion	TH	04	-	-	20	20	60	100	04	-	-	04
24P1405	PEC	Program Elective Course-1	TH	04	-	-	20	20	60	100	04	-	-	04
24P1406	PCCL	Thermal Engineering Lab-I	PR	-	-	04	20		30	50	-	-	02	02
24P1407	PECL	Program Elective Course-1Lab	PR	-	-	02	20		30	50	-	-	01	01
24P1408	PMFG	Study of Indian Constitution	SEMI	-	01	-	20		30	50	-	01		01
Total				**18**	**01**	**06**	**260**		**390**	**650**	**18**	**01**	**03**	**22**
Total Hours/ Week				**25**			**650**				**22**			

Elective-1	
Course Code	**Course Name**
24P1405-A	Measurements and Controls
24P1405-B	Advanced Energy Storage Technologies
24P1405-C	Advanced Internal Combustion Engines
24P1405-D	Hybrid and Electric Vehicles
24P1405-E	Generic Elective (GE) **

MOOC_1: NPTEL Courses under SWAYAM for AY 2024-25	
Course Code	**Course Name**
24P1402-A	Applied Numerical Methods
24P1402-B	Applied Thermodynamics for Engineers
24P1402-C	Energy Conservation and Waste Heat Recovery
24P1402-D	Sustainable Power Generation Systems

****GE:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa.

Matoshri College of Engineering and Research Centre (Autonomous)
Curriculum Structure for Master of Technology(M.Tech) in Heat Power Engineering (Course 2024)
Table No 7: First Year Master of Technology (F.Y. MTech)
Semester II

Courses				Teaching Scheme Hrs/Week			Examination and Marks (% of Total Curriculum and Marks)				Credit			
							In Sem Exam. (40%)		End Sem. Exam. (60%)	Marks				
Course Code	Course Type	Title of Course	Exam Head	Lect	TUT	PR	CAT	CCE	ESE	Total	TH	TUT	PR	Total
24P1409	MDC	MOOC_2	TH	02	-	-	10	10	30	50	02	-	-	02
24P1410	PCC	Advanced Heat Transfer	TH	04	-	-	20	20	60	100	04	-	-	04
24P1411	PCC	Design of Heat Exchanger	TH	04	-	-	20	20	60	100	04	-	-	04
24P1412	PEC	Program Elective Course-2	TH	04	-	-	20	20	60	100	04	-	-	04
24P1413	PCCL	Thermal Engineering Lab-II	PR	-	-	04	40		60	100	-		02	02
24P1414	PECL	Program Elective Course-2 Lab	PR	-	-	04	40		60	100	-	-	02	02
24P1415	PMFG	Project and Finance Management	SEMI	-	01	02	20		30	50	-	01	01	02
24P1416	AEC	Human Rights	TW	-	02	-	20		30	50	-	02	-	02
Total				**14**	**03**	**10**	**260**		**390**	**650**	**16**	**01**	**05**	**22**
Total Hours/ Week				**27**			**650**				**22**			

Elective-2	
Course Code	**Course Name**
24P1412-A	Battery Thermal Management System
24P1412-B	Environmental Engineering And Pollution Control
24P1412-C	Air Conditioning Systems
24P1412-D	Alternate Fuels For IC Engines
24P1412-E	Generic Elective (GE)**

MOOC_2: NPTEL Courses under SWAYAM for AY 2024-25	
Course Code	**Course Name**
24P1409-A	Energy Resources and conversion processes
24P1409-B	Cryogenic Engineering
24P1409-C	Conduction And Convection Heat Transfer
24P1409-D	Two Phase Flow And Heat Transfer

****GE:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa.

Matoshri College of Engineering and Research Centre (Autonomous)
Curriculum Structure for Master of Technology(M.Tech) in Heat Power Engineering (Course 2024)
Table No 8: Second Year Master of Technology (S.Y. MTech)
Semester III

Courses				Teaching Scheme Hrs/Week			Examination and Marks (% of Total Curriculum and Marks)				Credit			
							In_Sem Exam (40%)		End_Sem Exam (60%)	Marks				
Course Code	Course Type	Title of Course	Exam Head	Lect	TUT	PR	CCE	CCE	ESE	Total	TH	TUT	PR	Total
24P1417	PCC	MOOC_3 Cyber Security	TH	04	-	-	20	20	60	100	04	-	-	04
24P1418	PCC	Computational Fluid Dynamics	TH	04	-	-	20	20	60	100	04	-	-	04
24P1419	PEC	Program Elective Course -3	TH	04	-	-	20	20	60	100	04	-	-	04
24P1420	PCCL	Thermal Engineering Lab-III	PR	-	-	02	20		30	50	-	-	01	01
24P1421	PMFG	Company Law and Corporate Governance	SEMI	-	01	-	20		30	50	-	01	-	01
24P1422	PROJ	Dissertation Stage-I	PROJ	-	-	12	40	40	120	200	-	-	06	06
Total				**12**	**01**	**14**	**240**		**360**	**600**	**12**	**01**	**07**	**20**
Total Hours/ Week				**27**			**600**				**20**			

Elective-3	
Course Code	**Course Name**
24P1419-A	Cogeneration and Waste Heat Recovery Systems
24P1419-B	Gas Turbines and Jet Propulsion
24P1419-C	Cryogenic Engineering
24P1419-D	Advanced Power Plant Engineering
24P1419-E	Generic Elective (GE) **

MOOC_3: NPTEL Courses under SWAYAM for AY 2025-26	
Course Code	**Course Name^**
24P1417-A	**^Note:** Course Names will be declared as per availability of NPTEL courses of 12/16 weeks available in that particular year for the semester.
24P1417-B	
24P1417-C	
24P1417-D	

****GE:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa.

Matoshri College of Engineering and Research Centre (Autonomous)
Curriculum Structure for Master of Technology(M.Tech) in Heat Power Engineering (Course 2024)
Table No 9: Second Year Master of Technology (S.Y. MTech)
Semester IV

Courses				Teaching Scheme Hrs/Week			Examination and Marks (% of Total Curriculum and Marks)				Credit			
							In_Sem Exam (40%)		End_Sem Exam (60%)	Marks				
Course Code	Course Type	Title of Course	Exam Head	Lect	TUT	PR	CCE	CCE	ESE	Total	TH	TUT	PR	Total
24P1423	INT	Internship$	TW	-	-	$	40	40	120	200	-	-	08	08
24P1424	PCC	MOOC_4	TH	02	-	-	20	20	60	100	02	-	-	02
24P1425	SEC	Skill Development in Thermal Systems/MOOC	PR	-	01	02	10	10	30	50	-	01	01	02
24P1426	PROJ	Dissertation Stage-II	PROJ	-	-	16	50	50	150	250	-	-	08	08
Total				**02**	**01**	**18**	**240**		**360**	**600**	**02**	**01**	**17**	**20**
Total Hours/ Week				**21**			**600**				**20**			

MOOC_4: NPTEL Courses under SWAYAM for AY 2025-26	
Course Code	**Course Name^**
24P1424-A	^**Note:** Course Names will be declared as per availability of NPTEL courses of 12/16 weeks available in that particular year for the semester
24P1424-B	
24P1424-C	
24P1424-D	

$ Internship:

- Internship corresponding to major courses is to be completed after semester III Examinations and before commencement of semester IV of at least 180 hours/ 6 weeks; and it is to be assessed and evaluated in semester IV.
- It is almost imperative that the commencement of Semester IV needs to be approx. 3 weeks beyond the schedule.

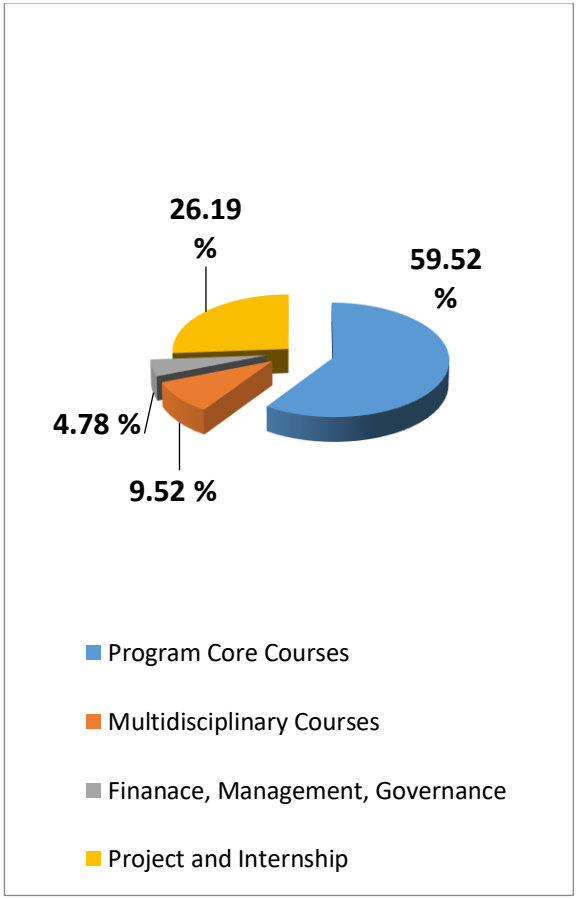
LJBhangale

Prof. Dr. Jayant H. Bhangale

Chairman BOS & Head- Mechanical Engineering

Matoshri College of Engineering Research Centre NASHIK Eklahare

Table 10: Broad Courses' Categories, and Credit Distribution				
Broad Category	**Description**	**Credit**	**Total Credit**	**%**
Program Courses **Total Credit= 50** **59.52%** **(19.00 % in online mode)**	Programme Core Course	30	35	**41.66**
	Programme Core Course Lab	05		
	Programme Elective Course	12	15	**17.85**
	Programme Elective Course Lab	03		
Multidisciplinary Courses **Total Credit = 26** **09.52%**	Multidisciplinary Course	08	08	**09.52**
Project Management, Finance, and Governance **Total Credit =04** **04.78%**	Study of Indian Constitution	01	04	**04.78**
	Project Management and Finance	02		
	Company Law and Governance	01		
Experiential Learning Courses **Total Credit =22** **26.19%**	Project	14	22	**26.19**
	Internship / On Job Training	08		
Total		**84**	**84**	**100**



Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1401: Advanced Fluid Mechanics

Teaching Scheme	Credit	Examination Scheme
TH: 03 Hours/Week	**03**	**CAT: 20 Marks** **CCE: 20 Marks** **End_Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Fluid Mechanics (UG)

Companion Course, if any: Thermal Engineering Lab-I (24P1401)

Course Objectives:

1. To familiarize kinematic and dynamic behavior of fluid flow
2. To introduce Navier-Stokes equation pertinent to steady and unsteady flows
3. To introduce flow dynamics over immersed bodies
4. To impart the knowledge of boundary layers and Flow separation
5. To impart knowledge on Turbulent flow and Compressible Flow

Course Outcomes: On completion of the course, learner will be able to–	BL
CO1: -Apply problem-solving skills for providing efficient solutions for the computational problem of fluid mechanics.	3
CO2: -Apply NSE in real time engineering problems to model low and high Reynolds number flow and boundary layer flows	3
CO3: -Understand the concept of potential flow, be able to effectively utilize it to solve the complex problems based on rotational and irrotational flows	2
CO4: -Apply the knowledge of perturbation and asymptotic methods and analyze boundary layer flows.	3
CO5: -Ability to derive the equation for viscous flow, including laminar flow and turbulent flow and to address such problems in engineering to solve the problems	4
CO6:-Identify, define, analyse, formulate, and solve problems related to fluid Mechanics by applying laws of Fluid mechanics.	4

Course Contents

Unit I	**Governing Equations**	**(08 Hrs)**

Review of Fluid Mechanics: - Definition and properties of Fluids, Fluid as continuum, Continuum model, Flow kinematics:- Langragian and Eulerian description, Substantial or Total derivatives, Basic flow-analysis techniques, Flow Patterns: Streamlines, Streaklines, and Pathlines

Integral Relations for a Control Volume: Reynolds transport theorem, Conservation of mass, Linear momentum equation, Energy equation, Frictionless flow, Bernoulli equation

Differential Relations for a Fluid Particle: Acceleration field of a fluid, Differential equation of mass conservation, Differential Equation of linear momentum, Differential equation of Energy, Boundary Conditions for the basic equations, Velocity Potential, Stream Function, Vorticity

Unit II	**Navier-Stokes Equations**	**(10 Hrs)**

Generalized form of NSE, Special forms: Euler equations, Bernoulli equation,
Exact solutions: fully developed flow in channel, pipe, flow between concentric rotating cylinders, Couette flow, Stokes First problem (unsteady flow), Creeping flow past a sphere, cylinder.
Analysis of numerical schemes: concept of consistency, accuracy, stability and convergence; Error and stability analysis; some applications.

Unit III	**Potential Flows**	**(10 Hrs)**

Elementary Plane-Flow Solutions: Circulation, Superposition of Plane-Flow Solutions: Irrotational vortex, Vortex Lines, vortex tubes,Vortex flow, Doublet, Flow past a circular cylinder, Magnus effect; Vortex Lines, vortex tubes.Role of viscosity in rotational and irrotational flows.,Kelivin's circulation theorem; Kutta-Joukowski lift theorem; Concept of lift and drag. Role of viscosity in rotational and irrotational flows.

Unit IV	**Boundary Layers**	**(09 Hrs)**

Boundary layer assumptions, equations, Flow over a flat plate, Similarity (Blasius) solution, Falkner-Skan equation, Momentum integral method, Flow separation. Effect of pressure gradient, Separation, Secondary flow, perturbation techniques

Unit V	**Turbulent flow and Compressible Flow**	**(09 Hrs)**

Introduction, characteristics of turbulence, laminar-turbulent transition, Correlation functions, Mean and fluctuations, Governing equations, Turbulent boundary layer, Boundary conditions, shear stress models, Prandtl's mixing length, Velocity profile over a flat plate and in pipes, Equations for free shear layers: mixing layer, plane and axisymmetric jet, and wake, Various Turbulent Models, Taylor's theory of turbulence dispersion.
One-dimensional flow: Speed of sound, Variable cross-section flow, Converging diverging nozzle, Fanno and Rayleigh curve, Normal shock relations, Introduction to oblique shocks, Prandtl-Meyer expansion waves

Reference Books:

1. Advanced Fluid Mechanics, G. Biswas and K. Muralidhar, Narosa Publisher
2. Viscous Fluid Flow, F. M. White, Tata McGraw Hill
3. Boundary Layer Theory, H. Schlichting, Springer
4. Fluid Mechanics, Yunus A. Cengel, Tata McGraw Hill
5. Fluid Mechanics, F.M. White, Tata McGraw Hill Int.
6. Advanced Fluid Mechanics, G. Biswas and K. Muralidhar, Narosa Publisher
7. Viscous Fluid Flow, F. M. White, Tata McGraw Hill
8. Boundary Layer Theory, H. Schlichting, Springe

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	3	-	2	2	2	2	3
CO2	2	3	3	2	3	3	2	3
CO3	2	2	2	2	2	1	3	2
CO4	2	2	3	2	2	3	2	2
CO5	2	2	3	2	2	2	2	2
CO6	2	2	3	2	2	3	2	2

Matoshri College of Engineering & Research Centre, Nashik **Master of Technology in Heat Power Engineering 2024-25** **First Year MTech Heat Power Engineering** **24P1402: MOOC-1**		
Teaching Scheme	**Credit**	**Examination Scheme**
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

MOOC Courses for AY 2024-25

MOOC-1: Udemy Courses for AY 2024-25#	
Course Code	**Course Name**
24P1402-A	Applied Numerical Methods for Engineering & Science Students
24P1402-B	Thermodynamics for Engineering Students
24P1402-C	Waste Heat Recovery
24P1402-D	Renewable Energy Technology: Green & Sustainable Development

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year M.Tech Heat Power Engineering

24P1403: Research Methodology

Teaching Scheme	Credit	Examination Scheme
TH: 02 Hours/Week	02	CAT: 20 Marks CCE: 20 Marks End_Sem: 60 Marks Total: 100 Marks

Companion Course, if any:

Course Objectives:

1. To understand basic concepts of research and its methodologies
2. To learn the methodology to conduct the Literature Survey
3. To acquaint with the tools, techniques, and processes for statistical analysis
4. To effectively use and compare optimization techniques for solving problems involving single and multi-parameter cost functions.
5. To understanding sampling theory and its application in research

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: Identify fundamental concepts, purposes, processes, and motivations of research, encompassing various paradigms, types, and scientific postulates.	1
CO2: Conduct a literature survey, define a clear research statement, develop a comprehensive research plan, identify diverse research tools, and present the report.	5
CO3: Conduct comprehensive statistical analyses, including error and uncertainty assessments, and perform hypothesis testing on research data.	4
CO4: Apply various optimization techniques to solve complex research problems involving single and multi-parameter cost functions and, present the results and methodologies in a comprehensive technical report.	3
CO5: Apply sampling theory and estimation techniques to determine sample size for estimating population parameters in research by presenting the findings.	3
CO6: Develop the skills to conduct comprehensive research, encompassing the definition of research statements, literature surveys, and the application of statistical analyses, optimization techniques, and sampling methods. Use these skills to provide innovative solutions for complex, real-life problems, and present your findings in a substantial technical report.	5

Course Contents

Unit I	**Introduction**	**(07 Hours)**

Evolution of Research Methodology: Meaning, nature, scope, and significance of research; Research paradigm; The purpose and Products of Research; Reasons for doing research, Objectives of research, Motivation for research; Postulates underlying scientific investigations; Types of research; Research process and work flow.

Engineering Research-Why? Research Questions, Engineering Ethics, conclusive proof-what constitutes A research project-Why take on?

Case Studies (if any)	Code of Ethics, IEEE Code of Ethics, ACM Software Engineering Code of Ethics and ProfessionalPractice, Code of Ethics especially covering Engineering discipline, various aspects- environment, sustainable outcomes, employer, general public, & Nation, Engineering Disasters

Unit II	**Literature Search and Review, developing Research Plan**	**(07 Hours)**
Archival Literature, Why should engineers be ethical? Types of publications- Journal papers, conference papers, books, standards, patents, theses, trade magazine, newspaper article, infomercials, advertisement, Wikipedia & websites, Measures of research impact, Literature review, publication cost. Developing Research Plan: Research Proposals, Finding a suitable research questions, The elements of research proposals-title, details, budget, Design for outcomes-1D data, 2D data, 3D data, N-D data, The research tools- Experimental measurements, numerical modeling, theoretical derivations & Calculations, curve matching.		
Case Studies (if any)	Engineering dictionary, Shodhganga,The Library of Congress, Research gate, Google Scholar, Bibliometrics, Citations, Impact Factor, h-index, I-index, plagiarism, copyright infringement.	
Unit III	**Statistical Analysis**	**(07 Hours)**
Statistical Analysis: Introduction, Sources of error and uncertainty, One-Dimensional Statistics: combining errors and uncertainties, t-test, ANOVA statistics, example, Two-Dimensional Statistics: example, Multi-Dimensional Statistics: partial correlation coefficients, example, Null hypothesis testing		
Case Studies (if any)	GNU PSPP Tool, SOFA, NOST-Dataplot	
Unit IV	**Optimization Techniques**	**(07 Hours)**
Optimization Techniques: Introduction, Two-parameter optimization methods: sequential uniform sampling, Monte Carlo optimization, Simplex Optimization method, Gradient Optimization method, Multi-parameter optimization methods, The cost function.		
Case Studies (if any)	Google Optimization Tools, OpenMDAO	
Unit V	**Data Sampling**	**(07 Hours)**
Sampling Fundamentals: Need for Sampling, Some Fundamental Definitions, Important Sampling Distributions, Central Limit Theorem, Sampling Theory, Sandler's A-test, Concept of Standard Error, Estimation, Estimating the Population Mean (μ), Estimating Population Proportion, Sample Size and its Determination		
Case Studies (if any)	Determination of Sample Size through the ApproachBased on Precision Rate and Confidence Level	

Books:

Textbooks:

1. David V Thiel, "Research Methods- for Engineers", Cambridge University Press, ISBN:978-1-107-61019-4
2. Kothari C.R., "Research Methodology. New Age International, 2004, 2nd Ed; ISBN:13: 978-81-224-1522-3.

Reference Books:

1. Caroline Whitbeck, "Ethics in Engineering Practice and Research", 2nd Ed., Cambridge University Press; ISBN :978-1-107-66847-8
2. Gordana DODIG-CRNKOVIC, "Scientific Methods in Computer Science", Department of Computer Science Malardalen University, Vasteas, Sweden; ISBN:91-26-97860-1

E-books:

1. Research Methodology- https://www.drnishikantjha.com/papersCollection/Research%20Methodology%20.pdf
2. Research Methodology Tools and Techniques- https://www.euacademic.org/BookUpload/9.pdf

MOOC Courses

- Introduction to Research- https://onlinecourses.nptel.ac.in/noc23_ge36/preview
- Research Methodology- https://onlinecourses.nptel.ac.in/noc22_ge08/preview
- Introduction to Research- https://nptel.ac.in/courses/121106007

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	2	3	2	2	2	1	1
CO2	3	3	3	2	3	3	2	1
CO3	3	3	2	2	2	2	1	1
CO4	3	3	3	2	2	3	2	2
CO5	3	3	3	2	2	3	2	2
CO6	3	3	3	2	2	3	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1404:Advanced Thermodynamics and Combustion

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End_Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Engineering and Applied Thermodynamics at UG

Companion Course, if any: Thermal Engineering Lab-I (24P1406)

Course Objectives:

1.To provide the sufficient knowledge of thermodynamics to apply in real engineering problems

2. To understand phase change processes of pure substances, other Equations of State and laws of thermodynamics

3. Toacquirethe knowledge of irreversibility and analysis of entropy and exergy

4. To familiarize the students about the thermodynamic relations and process and their use toanalysis the given thermal application

5. To understand the mechanism of combustion of fuel and Composition of gas mixture

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1:-Understand properties of pure substances and other ideal gas equations	**2**
CO2:-Apply the concepts of laws of thermodynamics and entropyfor thermodynamics systems.	**3**
CO3:-Carry out exergy analysis of thermodynamic systems	**4**
CO4:-Derive various thermodynamic relations such as Maxwell Relations Joule-Thomson, ClausiusClapeyron, etc. and apply these for evaluation of thermodynamic properties.	**3,4**
CO5:-Apply first and second law analysis of reacting systems and Analysethecombustionmechanismsofvariousfuels	**3,4**
CO6: Applythe principles of thermodynamicsto design and Analysis of thermal devices by engaging in experiential learning.	**4**

Course Contents

Unit I	**Properties of pure substance and Equation of state**	**(08Hrs)**

Phase change process of pure substances, PVT surface, P-v &P- T diagrams, Use of steam tables and charts in common use. Equations of states for real gases Vander waal's equation of state. other equations of state, generalized Compressibility chart, Law of corresponding states

Unit II	**Laws of thermodynamics**	**(08Hrs)**

Review of the Laws of Thermodynamics,Entropy and entropy generation, Increase of entropy principle, entropy change of pure sub, T-ds relations, absolute entropy and the third law of thermodynamics.

Unit III	**Exergy**	**(08Hrs)**

Concept of reversible work and irreversibility, Second-Law Efficiency,ExergyTransfer by Heat and Work**,** The Decrease of Exergy principle and exergydestruction**,** ExergyBalance,exergy analysis of power and refrigeration cycles.

Unit IV	Thermodynamic Property Relations	(08Hrs)
General thermodynamics relations; Fundamentals of partial derivatives; Partial Differentials, Maxwell relations, relations for specific heats; internal energy enthalpy and entropy; Joule - Thompson coefficient; Clapeyron equation.		
Unit V	**Combustion**	**(10Hrs)**
Combustion Modes and Flame Types, Fuels and Combustion,Stoichiometry,StandardizedEnthalpyTheoretical and Actual Combustion Processes Enthalpy of Formation and Enthalpy of Combustion, Heating Values, First and second Law Analysis of Reacting Systems, Adiabatic Flame Temperature,Entropy Change of Reacting Systems,Gas Mixtures – Mass & mole fractions, Dalton's law of partial pressure, Amagat'slaw,Kay'srule		

Books

Text Books:

1. YunusCengel,Michael Boles, " ThermodynamicsAn Engineering Approach", McGraw Hill Publication

Reference Books:

1. Michael J. Moran,Howard N. Shapiro "Fundamentals of Engineering Thermodynamics", John Wiley; 8th edition, ISBN-978-1-118-41293-0
2. Robert Balmer, "Modern Engineering Thermodynamics",Elseveir, ISBN-978-0-12-374996-3
3. Kenneth Wark,"Advanced Thermodynamics for Engineers", McGrawHill
4. Sonntag,Borgnakke,VanWylen, "Fundamentals of Engineering Thermodynamics", John Wiley, ISBN 978-1-118-13199-2
5. Stephen R. Turns, "AnIntroduction To Combustion*Concepts and Applications*",McGrawHill

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	2	2	3	2
CO2	1	1	2	2	3	3	3	2
CO3	2	1	2	2	2	2	3	2
CO4	2	1	1	2	2	3	3	2
CO5	1	1	1	2	2	3	3	2
CO6	2	1	1	2	2	3	3	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1405A:Measurements and Controls

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	04	CAT: 20 Marks CCE: 20 Marks End_Sem: 60 Marks Total: 100 Marks

Prerequisite: -Measurement Lab (UG)

Companion Course, if any:

Course Objectives:

1. Understand the fundamental concepts of measurement, including accuracy, precision, resolution, and calibration.
2. Identify and analyze different types of sensors and transducers used for measuring various physical quantities such as temperature, pressure, flow, and level.
3. Explore the principles and methodologies of signal conditioning and amplification to enhance the accuracy and reliability of measured signals.
4. Learn about data acquisition systems and instrumentation techniques for acquiring, processing, and analyzing measurement data.
5. Analyze the characteristics and behavior of dynamic systems and their response to control inputs.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: -Understand the principles of measurement	**2**
CO2: -Apply measurement and control principle.	**3**
CO3: -Apply the principles of measurementforField quantities	**3**
CO4: -Apply the principles of measurement for derived quantities	**3**
CO5: -Analyze electronic Controller.	**4**
CO6:-Apply the knowledge ofscience of measurementon measurements tools by studying instruments types its characteristics for the improvements in accuracy and precisionin measurement.	**4**

Course Contents

Unit I	Instrument types and performance characteristics	(8 Hrs)

Active and Passive instruments, Null type and deflection type instruments, Analogue and digital instruments, Indicating instruments and instruments with signal output, smart and non-smart instruments. Static and Dynamic characteristics of instruments, Necessity of calibration

Unit II	Measurement Uncertainty	(08 Hrs)

Sources of Systematic Error, System Disturbance due to Measurement, Errors due to Environmental Inputs, Wear in Instrument Components, Accumulation of Accepted Error, Improper Functioning of Instruments, Dual Sensitivity Errors, Other Sources of Error, Minimizing Experimental Error, Statistical Analysis of Measurements subject to Random Errors, Aggregation of Measurement System Errors, Reduction of Systematic Errors, Quantification of Systematic Errors, Sources and Treatment of Random Errors, parameter estimation, regression analysis, correlations, analysis of data

Unit III	Measurements of field quantities	(06 Hrs)

Temperature, heat flux measurement, heat transfer coefficient, measurement of force, pressure, flow rate, velocity, humidity, noise, vibration.

Unit IV	Measurement of derived quantities	(08 Hrs)

Temperature, heat flux measurement, heat transfer coefficient, measurement of force, pressure, flow rate, velocity, humidity, noise, vibration Force, Acceleration, Torque, power, thermo physical properties, radiation and surface properties, Miscellaneous Measurements - Time, Frequency, and Phase-Angle Measurement, Liquid Level, Chemical Composition, Current and Power Measurement

Unit V	Basics of Controllers	(08Hrs)

P, PI, PID controllers, pneumatic and hydraulic controllers, electronic controllers, applications to machine tools, furnaces, material handling etc

Books

Text Books:

1. Mechanical Measurements, S.P. Venkateshan, Ane Books Pvt. Ltd.

Reference Books:

1. Measurement Systems-Application and Design, Doebelin E.O., McGraw Hill Publication.
2. Measurement and Instrumentation – Theory and Application, Alan Morris, Reza Langari, Elsevier.
3. Instrumentation for Engineering Measurements, James Dally, William riley and Kenneth McConnell, Wiley.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	3	2	2	2
CO2	1	1	2	2	3	3	2	2
CO3	2	1	2	2	2	2	2	2
CO4	2	1	1	2	2	3	2	2
CO5	1	1	1	-	2	3	2	2
CO6	2	1	1	2	2	2	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1405-B: Advanced Energy Storage Technologies

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	04	CAT: 20 Marks CCE: 20 Marks End_Sem: 60 Marks Total: 100 Marks

Prerequisite:-

Course Objectives:

1. To understand the various types of energy storage technologies and its applications.
2. To study the various modeling techniques of energy storage systems using TRNSYS.
3. To learn working concepts and types of batteries.
4. To make the students to get understand the concepts of Hydrogen and Biogas storage.
5. To provide the insights on super capacitor, Fly wheel and compressed energy storage system.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: - Identify the energy storage technologies for suitable applications.	**2**
CO2: - Analyze the energy storage systems using TRNSYS	**4**
CO3: - Summaries the concepts and types of batteries	**2**
CO4: - Examine the principle of operation of Hydrogen and Biogas storage systems	**2**
CO5: - Explain the working of super capacitor, Flywheel and compressed energy storage	**2**
CO6: Apply theoretical knowledge to advanced Energy Storage technologies and improve energy efficiency in domestic and industrial systems	**4**

Course Contents

Unit I	**Introduction**	**(08 Hrs)**

Necessity of energy storage–types of energy storage–comparison of energy storage technologies– Applications.

Unit II	**Thermal Storage System**	**(09 Hrs)**

Thermal storage–Types–Modelling of thermal storage units–Simple water and rock bed storage system–pressurized water storage system–Modelling of phase change storage system –Simple units, packed bed storage units – Modelling using porous medium approach, Use of TRNSYS

Unit III	**Electrical Energy Storage**	**(10 Hrs)**

Fundamental concept of batteries–measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel–Cadmium, Zinc Manganese dioxide and modern batteries for example (i)zinc-Air (ii)Nickel Hydride ,(iii)Lithium Battery.

Unit IV	**Hydrogen And Biogas Storage**	**(08Hrs)**

Hydrogen storage options–compressed gas–liquid hydrogen–Metal Hydrides, chemical Storage, Biogas storage-comparisons. Safety and management of hydrogen and Biogas storage- Applications

Unit V	**Alternate Energy Storage Technologies**	**(08Hrs)**
Flywheel, Super capacitors, Principles & Methods–Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications		

Books

Text Books:

1. BrahimDincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications,John Wiley & Sons 2010.

Reference Books:

1. Viswanathan, Fuel cell principle and applications university press,2006
2. Luisa F.Cabeza, Advances in Thermal Energy Storage Sy stems: Methods and Applications, Elsevier Wood head Publishing, 2015
3. Robert Huggins, Energy Storage: Fundamentals, Materials andApplications,2nd edition,Springer,2015.
4. Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage andconversion,,Wileypublications,2012
5. National Energy Technology Laboratory, U.S. Department of Energy, Fuel Cell Handbook(Seventh Edition)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	3	2	2	2
CO2	1	1	2	2	2	3	2	2
CO3	2	1	2	2	2	2	2	2
CO4	2	1	1	2	2	2	2	2
CO5	1	1	1	2	2	2	2	2
CO6	2	1	1	2	2	2	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1405-C: Advanced Internal Combustion Engines

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End_Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Applied Thermodynamics ,IC Engine (UG)

Course Objectives:

1. To gain insight on the working principle of spark ignition engines and compression ignition engines.
2. To study the pollutant formation and its control in IC engines.
3. To study the recent technologies adopted in IC engine application
4. To identify the alternative fuels for internal combustion engine.
5. To understand the recent trends of IC Engine.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: To understand the workingprinciple of IC engines	**2**
CO2: To understand the process of combustion in S.I.andC.I.engine	**2**
CO3: IDENTIFY factors affecting on combustion and Combustion chamber	**2**
CO4: IDENTIFY the source of pollution and control of pollution	**2**
CO5: Understand therecent trends in ICengines	**2**
CO6: Apply theoretical knowledge of Internal Combustion Engines to real-world scenarios by engaging in experiential learning activities such as high-end equipment demonstrations, participating in industry visits, and organizing or participating in technical events so as to inbibe problem-solving skills, foster innovation, and build professional competencies necessary for successful careers in engineering.	**4**

Course Contents

Unit I	**Introduction**	**(08Hrs)**

Engine Classifications, Engine Operating Cycles, Engine Components,Engine Design and Operating Parameters, Engine Design and Performance Data, Characterization of Flames, Combustion Stoichiometry

Unit II	**Spark Ignition Engines**	**(08Hrs)**

Combustion Fundamentals, SI Engine Combustion Process, Stages of combustion, Combustion Process Characterization, Flame Structure And Speed, Cyclic Variations in Combustion, Partial Burning, And Misfire ,Abnormal Combustion: Spontaneous Ignition And Knock

Unit III	**Compression Ignition Engines**	**(09Hrs)**

Types of Diesel Combustion Systems,Diesel Engine Combustion,Stages of combustion in C.I. Combustion chambers – Fuel spray behaviour – spray structure, spray penetration and evaporation – air motion – Introduction to Turbo charging

Unit IV	**Pollutant Formation And Control**	**(08Hrs)**

Pollutant – Sources – Formation of carbon monoxide, Unburnt hydrocarbon, NO_x, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters and Particulate Traps – Methods of measurements and Introduction to emission norms and Driving cycles

Unit V	**Recent Trends**	**(09 Hrs)**

Lean Burn Engines – Stratified charge Engines – homogeneous charge compression ignition engines – Plasma Ignition – Measurement techniques – laser Doppler, Anemometry. Use of nano technology in IC Engines.

Books

Text Books:

1. R.B. Mathur and R.P.Sharma, Internal Combustion Engines, DhanapatRai Publications,1993
2. V. Ganesan, Internal Combustion Engines, II Edition, Tata McGraw-Hill Education, 2002

Reference Books:

1. Heywood, J.B., Internal Combustion Engine Fundamentals, McGraw-Hill, 1988.
2. K.K. Ramalingam, Internal Combustion Engine fundamentals, Scitech Publications, 2002.
3. Kirpal Singh, Automobile Engineering Vol - I, Standard Publishers, Delhi 2013.
4. Willard W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall, 1997

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	3	2	-	2	2
CO2	1	1	2	2	2	3	2	2
CO3	2	1	2	2	2	2	2	2
CO4	2	1	1	2	2	3	2	2
CO5	1	1	1	2	2	3	2	2
CO6	2	1	1	2	2	3	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year M.Tech Heat Power Engineering

24P1405-D:Hybrid and Electric Vehicles

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End_Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: - Nil

Companion Course, if any: Nil

Course Objectives:

- To introduce the concept of hybrid and electric drive trains.
- To understand and utilize different types of energy storage systems
- To elaborate on the types and utilization of hybrid and electric drive trains
- To expose on different types electric machine and drive trains
- To introduce recent trends EV and HEV

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: -Understand the need for electric vehicles and classify based on configuration	**2**
CO2: -Understand suitable energy storage system for a hybrid / electric vehicle	**2**
CO3: -Understand the fundamentals of HEV and its components sizing	**2**
CO4: -Selection of electric motors and its drive trains	**3**
CO5: -Analyze recent trends and technology of EV and HEV with recent models	**4**
CO6:-Apply theoretical knowledgeHybrid and Electric Vehicles to real-world scenarios by engaging in experiential learning activities such as high-end equipment demonstrations, participating in industry visits, and organizing or participating in technical events so as to inbibe problem-solving skills, foster innovation, and build professional competencies necessary for successful careers in engineering.	**4**

Course Contents

Unit I	**Introduction**	**(08 Hrs)**

Need of Electric Vehicles, Components of an EV,EV History, Recent EVs and HEVs,EVAdvantages,Types of Hybrids, Advantages and Disadvantages Reciprocating Engines,Design of an HEV,Hybrid Drive trains, Sizing of Components

Unit II	**Energy Sources and Energy Storage**	**(10 Hrs)**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles,BatteryBasics,Lead-Acid Battery, Alternative Batteries , Battery Parameter, Technical Characteristics, Fuel Cell, Fuel Cell Types, Hydrogen Storage Systems,Supercapacitors and Ultra capacitors,Flywheels, wireless charging

Unit III	**HEV Fundamentals**	**(08 Hrs)**

Vehicle Model, Vehicle Performance,EV Power train Component Sizing, Series Hybrid Vehicle, Parallel Hybrid Vehicle, Electrically Peaking Hybrid Concept, ICE Characteristics ,Gradability Requirement, Selection of Gear Ratio from ICE to Wheel, Wheel Slip Dynamics

Unit IV	**Electric Machines and Drive trains**	**(08 Hrs)**

Motor and Engine Ratings,EV and HEV Motor Requirements,DC Machines and its drive,Three-Phase AC Machines and its drive,PM and SR Machines and its drive		
Unit V	**Recent Electric and Hybrid Vehicles and its future**	**(08Hrs)**
Introduction,Battery-Powered Cars and Vans,HybridVehicles,The Tesla S,The Honda FCX Clarity,MaglevTrains,Electric Road–Rail Systems, Commercialization and Future EV and HEVs		

Books

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

Reference Books:

1. Chris Mi, M. AbulMasrur .,Hybrid Electric Vehicles Principles and Applications with Practical Perspectives,John Wiley & Sons, Inc.,2018, II Edition.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	3	2	-	2	2
CO2	1	1	2	2	3	3	2	2
CO3	2	1	2	2	2	2	2	2
CO4	2	1	1	2	2	3	2	2
CO5	1	1	1	2	2	3	2	2
CO6	2	1	1	2	2	3	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1405-E: Generic Elective (GE)

TeachingScheme	Credit	ExaminationScheme
TH: 04 Hours/Week	04	CAT: 20 Marks CCE: 20 Marks End_Sem: 60Marks Total: 100 Marks

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1406: Thermal Engineering Lab-I

Teaching Scheme:	Credit	Examination Scheme:
PR: 04 Hours/Week	02	In Sem: 20 Marks End_Sem: 30 Marks Total: 50 Marks

Companion Course: Advanced Thermodynamics and Combustion, Advanced Fluid Mechanics

Course Outcomes: On completion of the course, learner will be able to–	BL
CO1: -To understand basic concepts of research and its methodologies	2
CO2: -To learn the methodology to conduct the Literature Survey	2
CO3: - To Understand fluid statics and dynamics	2
CO4:- To study basics of flow visualization and drag and lift forces	2
CO5: - ApplyExergyAnalysis to various devices and analyze the combustion process	3
CO6: -Apply knowledge of research methodology, fluid mechanics and thermodynamics to solve problem by conduct literature surveys, understand fluid statics and dynamics, exergy analysis to devices, and analyze combustion processes.	4

Suggested List of Laboratory Experiments/Assignments
(Any 5 laboratory assignments)

CO Mapping: CO1 to CO5 for all Lab Assignments

Sr. No.	Experiments/Assignments	CO Mapping
1	Use an academic web search to locate a journal paper which describes a design outcome in your field of interest (i.e. your engineering discipline).You must enter several keywords which relate to your topic. Read the paper and, using your own words, demonstrate your understanding of the paper by: Brief Contribution Performance metric, data set, comparative analysis and outcomes. Writing out the major conclusions of the paper. Outlining the verification method(s) used to support these conclusions. Describing the author's reflective comments on the quality of the design (positive and negative). The positive and negative environmental impacts. After reading a published research paper, write down the research question you think the author have addressed in undertaking this research. Do you think the paper adequately supports the conclusions reached in addressing the question?	1& 6

2	Consider a journal article in your discipline that was published approximately five years ago. Note the keywords and type them into one of the web-based academic search engines (e.g. googlescholar.com). Does the original article appear in the search results? How many citations does this article have? Have the same authors published further work in this field? Compare the citations of this paper with those from the most highly cited paper in the search results? How many citations does this highly cited article have? If this paper was published before your original article, is it cited in your article? Do you think this high-cited paper should have been listed as a reference in your original article? Give reasons for your decision. Read a journal paper from your discipline. Following the format of patents, write out one or more important outcomes from the paper in terms of one or more Patent Claims 1, 2…. .	2& 6
3	Flow through a converging-diverging nozzle: subsonic and supersonic flows	3& 6
4	Friction factor determination: incompressible flow through pipes/ducts of variable cross section	4& 6
5	Exergy Analysis of real devices (Heat Exchangers, Vapor Compression cycle, Compressors, Power plants etc.)	5& 6
6	Preparation of computer program to study the effect of percentage of theoretical on adiabatic flame temperature and equilibrium composition for a hydrocarbon fuel. (Program to be run for variable input data.)	5 & 6

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	2	2	2	3	-	1	1
CO2	2	3	2	2	3	3	1	1
CO3	2	2	2	2	2	2	2	2
CO4	1	2	1	1	2	3	2	2
CO5	1	2	1	1	2	3	2	2
CO6	2	3	1	1	2	3	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1407: Elective Lab-I

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 Hours/Week	01	In_Sem: 20 Marks End_Sem: 30 Marks Total: 50 Marks

Companion Course: Elective -I

Syllabus Contents:

- The lab practice consists of the tutorials / experiments / Case Study / industrial visit / Industry base Mini project related to thermal systems as decided by the course supervisors of the Program Elective Core Lab (PECL) as follows
  1. Measurements and Controls
  2. Advanced Energy Storage Technologies
  3. Advanced Internal Combustion Engines
  4. Hybrid and Electric Vehicles
  5. Generic Elective (GE) **

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1408: Study of Indian Constitution

Teaching Scheme	Credit	Examination Scheme
TU: 01 Hours/Week	01	In_Sem: 20 Marks End_Sem: 30 Marks Total: 50 Marks

Prerequisite: Any graduate

Course Objectives:

- To acquaint with the basic principles of Constitution and Constitutionalism
- To understand the reasons, operation and justification of the growth of Fundamental Rights in India
- To learn the Directive Principles of India.
- To understand the powers, functions and structures of various Constitutional bodies.
- To study the constitutional operations in the context of social, economic and political.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: Apply knowledge of the historical background, key features, and provisions related to citizenship in the Indian Constitution to assess its relevance to contemporary governance.	3
CO2: Analyze and present findings for study of - the structure and classification of fundamental rights, directive principles of state policy, and fundamental duties enshrined in the Constitution.	6
CO3: Comprehend the roles, powers, and functions of the Union executive, Union Legislature, and Union judiciary, with a focus on parliamentary procedures and the Supreme Court..	2
CO4: Survey the composition, powers, and functions of the State executive, State Legislature, and State judiciary, including the role of Governors and High Courts.	4
CO5: Discover the legislative, administrative, and financial relations between the Union and State governments, including provisions for emergency, trade, and amendments to the Constitution.	4
CO6: Elaborate the Indian Constitution’s framework and its role in governing the structure and functioning of both the Union and State governments, fostering responsible citizenship.	6

Course Contents

Unit I	Introduction and Citizenship	(04 Hours)

Definition of constitution, historical back ground, salient features of the constitution. Preamble of the constitution, union and its territory. Meaning of citizenship, types, termination of citizenship.

Unit II	Rights in the Constitution and Directive principles of state policy	(06 Hours)

Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation. Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences. Directive principles of state policy, classification of directives, fundamental duties.

Unit III	Structure, Powers and Functions of Union Legislature	(05 Hours)

The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions. The parliament, composition, Rajyasabha, Loksabha, qualification and disqualification of membership, functions of parliament. Union judiciary, the supreme court, jurisdiction, appeal by special leave.		
Unit IV	**Structure, Powers and Functions of State Legislature**	**(05 Hours)**
The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories. The State Legislature, composition, qualification and disqualification of membership, functions. The state judiciary, the high court, jurisdiction, writs jurisdiction.		
Unit V	**Legislative relation between Union and State**	**(05 Hours)**
Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission. Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals. Official language, elections, special provisions relating to certain classes, amendment of the Constitution.		

Books:

Textbooks:

1 D DBasu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 24e, 2019
2 PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books:

1 Ministry of law and justice, The constitution of India, Govt of India, New Delhi, 2019.
2 JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019
3 MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	-	3	2	3	-	-	-
CO2	2	3	3	2	3	3	-	-
CO3	2	3	3	2	2	2	-	-
CO4	1	3	3	1	2	3	-	-
CO5	1	3	3	1	2	3	-	-
CO6	2	3	3	1	2	3	-	-

SEMESTER-II

Matoshri College of Engineering & Research Centre, Nashik **Master of Technology in Heat Power Engineering 2024-25** **First Year MTech Heat Power Engineering** **24P1409: MOOC-2**		
Teaching Scheme	**Credit**	**Examination Scheme**
TH: 02 Hours/Week	**02**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

NPTEL Courses under SWAYAM for AY 2024-25

MOOC-2: NPTEL Courses under SWAYAM for AY 2024-25#	
Course Code	**Course Name**
24P1409-A	**Note:** Course Names will be declared as per availability of NPTEL courses of 12/16 weeks available in that particular year for the semester
24P1409-B	
24P1409-C	
24P1409-D	

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1410: Advanced Heat Transfer

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End_Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Thermodynamics , Fluid Mechanics, Heat transfer

Companion Course, if any: -Thermal Engineering lab-II

Course Objectives:

1. Identify the important modes of heat transfer and their applications.
2 Analyze the thermal systems with heat generation and lumped heat capacitance.
3. Understand the mechanism of convective heat transfer
4. To understand the phenomenon of heat transfer with phase change
5. Determine the radiative heat transfer between surfaces.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1. Understand the fundamental governing equations of conduction, convection and radiation	2
CO2. Apply the analytical and numerical solutions for heat transfer problem	3
CO3. Analyze convective heat transfer problems encountered in different thermal systems.	4
CO4.Analyze convective heat transfer problems with phase change (boiling andcondensation).	4
CO5. Evaluate radiation heat transfer between black body and gray bodysurfaces	4
CO6. Apply Knowledge of Heat transfer and its application scenarios by engaging in experiential learning activities such as high-end equipment demonstrations, participating in industry so as to imbibe problem-solving skills, foster innovation, and build professional competencies necessary for successful careers in engineering	4

Course Contents

Unit I	**Modes and Laws of Heat Transfer**	**(08 Hrs)**

Steady and Transient Heat Transfer, Multidimensional Heat Transfer, Thermal Conductivity, Thermal diffusivity, Various Boundary and Initial Conditions, General Heat Conduction Equation, One-Dimensional, and Three Dimensional Steady-State Conduction, Thermal Resistance, Generalized Thermal Resistance Networks, Thermal Contact Resistance, Isotropic Material and Anisotropic Material.

Unit II	**Transient Heat Conduction**	**(09 Hrs)**

The Lumped Capacitance Method, Validity of the Lumped Capacitance Method, General Lumped Capacitance Analysis, Transient Heat Conduction in Large Plane Walls, Long Cylinders and Spheres, Spatial effects. Problems related with conventional geometries. Multi-Dimensional system, Transient numerical method, Thermal resistance and capacity formulation,Heisler and Grober charts,

Unit III	**Forced Convection and Natural Convection**	**(10 Hrs)**

Physical Mechanism of Convection, External forced convection, Parallel flow over Flat plates, Flow across cylinders and spheres, Flow across tube banks Internal Forced Convection.
Equation of motion and Grashof Number, Natural Convection over flat and inclined surfaces, Natural convection from finned surfaces and PCBs, Natural Convection inside enclosures, Combined Natural Convection and Radiation, Combined Natural and Forced Convection.

Unit IV	**Heat transfer with phase change**	**(08Hrs)**

Nucleate, film and pool boiling, boiling in forced convection; two phase flow,Filmwise and dropwise condensation; Heat pipes.

Unit V	**Thermal Radiation**	**(09 Hrs)**

Thermal radiation, Blackbody radiation, Radiation intensity, Radiation properties, Atmospheric and Solar radiation, Shape factor, Radiation heat transfer in two surface enclosures, Radiation shields, Radiation exchange between Emitting and Absorbing gases.

Books

Text Books:

1.YunusCengel, Boles, “HeatTransfer”,McGrawHill
2. Holman, J.P., Heat Transfer, Tenth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2017.
3.Sachdeva, T.R., Fundamentals of Engineering Heat and Mass Transfer, Fifth Edition, New Age International, 2017. .

Reference Books:

1.Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, Wiley
2.M.N.Ozisik, “Heattransfer-Abasicapproach”McGrawHill.
3. A Bejan, “ConvectiveHeattransfer”,JohnWileyand sons.
4. S.P.Sukhatme,“Heattransfer”,,UniversityPress

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	2	2	2	2	1	3	3
CO2	3	1	2	2	2	3	3	3
CO3	3	1	2	2	2	2	3	3
CO4	2	1	2	2	1	3	3	3
CO5	2	1	2	2	1	3	3	3
CO6	3	1	3	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1411-Design of Heat Exchanger

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Students are expected to have a good understanding of basic Heat and mass transfer (UG).

Companion Course, if any: -Thermal Engineering lab-II

Course Objectives:

1. To provides exposure to different kind of heat exchanger, their working and selection for a given application.

2. Enable the students to analyze and solve heat exchanger problems by applying principles of mathematics, science and engineering.

3.To understand the sizing and rating of the heat exchangers for various applications

4. Prepare students to use modern tools, techniques and skills to fulfill industrial needs related to design of heat exchanger.

5.Develop skills in the analysis of heat exchanger with mathematical modeling for applications in research or design.

Course Outcomes: On completion of the course, learner will be able to	**BL**
CO1. Understandthedifferent types of heat exchangers.	2
CO2. ApplyLMTDandEffectiveness-NTUmethodsinthedesignofheatexchangers	3
CO3. Analyse the pressure drop in heatexchanger.	4
CO4. Identify aspects of selection of materials for heat exchangers	3
CO5. Applytheprinciplesofdesign of heat exchanger for Condensers and Evaporators	4
CO6. Identify, define, analyse, formulate, and solve problems related to Heat Exchanger manufacturing systems by applying laws of heat transfer	4

Course Contents

Unit I	**Types of heat exchanger**	**(08 Hrs)**

Heat Exchangers – Classification according to transfer process, number of fluids, surface compactness, and construction features. Tubular heat exchanger, plate type heat exchangers, extended surface heat exchangers, heat pipe, Regenerators. Classification according to flow arrangement: counter flow, parallel flow, cross flow exchanger.

Unit II	**Basic Design Methods of Heat Exchangers**	**(8Hrs)**

Arrangement of Flow Paths in Heat Exchangers, Basic Equations in Design, Overall Heat Transfer Coefficient,LMTD Method for Heat Exchanger Analysis, The ε-NTU Method for Heat Exchanger Analysis, Heat Exchanger Design Calculation, Variable Overall Heat Transfer Coefficient, Heat Exchanger Design Methodology, Solution Methods for Determining Exchanger Effectiveness, Fouling of Heat Exchangers.

Unit III	Heat Exchanger Pressure Drop Analysis	(8Hrs)
Importance of Pressure Drop, Fluid Pumping Devices, Major Contributions to the Heat Exchanger Pressure Drop, Assumptions for Pressure Drop Analysis, Extended Surface Heat Exchanger Pressure Drop, Regenerator Pressure Drop, Tubular Heat Exchanger Pressure Drop,Plate Heat Exchanger Pressure Drop,Pipe Losses		
Unit IV	**Selection of Heat Exchangers and Their Components**	**(09 Hrs)**
Selection Criteria Based on Operating Parameters such as Operating Pressures and Temperatures,Cost,Fouling and Cleanability,Fluid Leakage and Contamination, Fluids and Material Compatibility, Fluid Type ,General Selection Guidelines for Major Exchanger Types,Shell-and-Tube Exchangers, Plate Heat Exchangers,Extended-Surface Exchangers, Regenerator Surfaces		
Unit V	**Condensers and Evaporators**	**(09 Hrs)**
Introduction, Shell and Tube Condensers, Steam Turbine Exhaust Condensers,PlateCondensers,Air-Cooled Condensers, Direct Contact Condensers., Thermal Design of Shell-and-Tube Condensers, Design and Operational Considerations, Design and Operational Considerations, Evaporators for Refrigeration and Air-Conditioning, Thermal Analysis, Cooling towers fundamentals.		

Books

Text Books:

1. Fundamentals of Heat Exchanger Design -Ramesh K. Shah, Dusan P. Sekulic,Wiley India.

Reference Books:

1. Heat exchangers Selection, Rating and Thermal Design – SadikKakac,Hongtan Liu, AnchasaPramunjanaroenkij, CRC Press
2. Process Heat Transfer – Donald Q. Kern, Tata McGraw-Hill
3. Process Heat Transfer – Hewitt ,Shires&Bott, CRC Press
4. Cooling Tower, Fundamentals- John C. Hensley, SPX Cooling Technologies

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	3	1	3	3
CO2	2	1	2	2	3	3	3	3
CO3	3	2	2	2	2	2	3	3
CO4	2	1	1	1	2	3	3	3
CO5	3	2	2	1	2	3	3	3
CO6	2	1	1	1	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1412-ABattery Thermal Management System

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: NIL

Course Objectives:

1. The objective of this course is to introduce learner to batteries, its parameters,modelling and charging requirements.
2. The course will help learner to develop battery management algorithms for batteries
3. To analyses the battery state of charge and its functions
4. To evaluate models using the range of simulation.
5. To Examine the design standards of a battery

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO.1 Interpret the role of battery management system	2
CO.2 Identify the requirements of Battery Management System	2
CO.3 Interpret the concept associated with battery charging / discharging process	2
CO.4 Calculate the various parameters of battery and battery pack	3
CO.5 Design the model of battery pack.	4
CO.6.Identify ethical, legal, security and social issues and address them in the development, implementation and management of manufacturing and automation systems.	4

Course Contents

Unit I	**Introduction**	**(08 Hrs)**

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithiumion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

Unit II	**Battery Management System Requirement**	**(09 Hrs)**

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of- charge estimation, Cell total energy and cell total power.

Unit III	**Battery State Of Charge And State Of Health Estimation, Cell Balancing**	**(10 Hrs)**

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Modelbased state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing

Unit IV	**Modelling And Simulation**	**(09 Hrs)**

Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, simulating an electric vehicle, Vehicle range calculations, simulating constant power and voltage, Simulating battery packs,

Unit V	**Design Of Battery BMS**	**(09 Hrs)**

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system

Books

Reference Books:

1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. ArtechHouse, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods,Artech House, 2015.
3. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems –Design byModelling" Philips Research Book Series 2002.
4. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" House, 2010
5. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication forbattery powered applications. Vol. 9. Springer Science & Business Media, 2008

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	1	2	2	3	3	2	3	3
CO.2	1	1	2	2	3	1	3	3
CO.3	2	1	2	2	2	1	3	3
CO.4	2	1	1	2	2	1	3	3
CO.5	1	1	1	2	2	1	3	3
CO.6	2	1	1	2	2	1	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1412-B: Environmental Engineering And Pollution Control

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**In_Sem1:20 Marks** **In_Sem2: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Energy Engineering (UG)

Companion Course, if any: -

Course Objectives:

1. To impart knowledge on the atmosphere and its present condition, global warming and eco-legislations.
2. To detail on the sources of air, water and noise pollution and possible solutions for mitigating their degradation.
3. To elaborate on the technologies available for generating energy from waste.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO.1 understand the Global Warming Potentials and Green house Effect	2
CO.2 understand the Concept of Air Pollution and its effect	2
CO.3 understand the Concept of water Pollution and its effect	2
CO.4.Analyse waste management technology	4
CO.5 Understand the Industrial Pollution and its effect	2
CO.6Apply Knowledge of Environmental Engineering And PollutionControl to reduce effect of pollution on Environment.	4

Course Contents

Unit I	**Introduction**	**(08 Hrs)**

Global atmospheric change – green house effect – Ozone depletion - natural cycles - mass and energy transfer – material balance – environmental chemistry and biology – impacts – Environmental. Legislations

Unit II	**Air Pollution**	**(09 Hrs)**

Pollutants - sources and effect – air pollution meteorology – atmospheric dispersion – indoor air quality - control methods and equipments - issues in air pollution control – air sampling and measurement

Unit III	**Water Pollution**	**(10 Hrs)**

Water resources - water pollutants - characteristics – quality - water treatment systems – wastewater treatment - treatment, utilization and disposal of sludge - monitoring compliance with Standards.

Unit IV	**Waste Management**	**(09 Hrs)**

Sources and Classification – Solid waste – Hazardous waste - Characteristics – Collection and Transportation - Disposal – Processing and Energy Recovery – Waste minimization

Unit V	Other Types Of Pollution From Industries	(09 Hrs)

Noise pollution and its impact - oil pollution - pesticides - instrumentation for pollution control - water pollution from tanneries and other industries and their control – environment impact assessment for various projects – case studies. Radiation pollution: types, sources, effects, control of radiation pollution

Books

Reference Books:

1. Arcadio P Sincero and G.A. Sincero, Environmental Engineering – A Design Apporach, Prentice Hall of India Pvt Ltd, New Delhi, 2002.
2. Bishop P., Pollution Prevention: Fundamentals and Practice, McGraw-Hill International Edition, McGraw-Hill book Co, Singapore, 2000.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 1998.
4. H.Ludwig, W.Evans, Manual of Environmental Technology in Developing Countries, International Book Company, Absecon Highlands N.J. (1991).
5. H.S.Peavy, D.R.Rowe and G.Tchobanoglous, Environmental Engineering McGraw- Hill Book Company, NewYork, (1985).
6. Rao C.S., Environmental Pollution Control Engineering, 2nd Edition, New Age International Publishers, 2006.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	3	1	3	3
CO2	1	1	2	1	3	3	3	3
CO3	2	1	2	1	2	2	3	3
CO4	2	1	1	1	2	3	3	3
CO5	1	1	1	1	2	3	3	3
CO6	2	1	1	1	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1412-C: Air Conditioning Systems

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: HVAC (UG)

Companion Course, if any: -

Course Objectives:

1. To learn the psychometric concepts underlying Air conditioning process.
2. To learn the design features and load estimation principles of specific Airconditioning system.
3. To learn about the critical auxiliary systems
4. To learn about the air distribution circuits, water distribution circuits etc.
5. To learn about the HVAC systems in air conditioning systems

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: Analysepsychometrically the Air conditioning processes.	4
CO2 : Estimate the heat load for summer and winter Air conditioning applications	4
CO3 :Understand and appreciate the utility of different Air conditioning systems for different applications	2
CO4 :Design a fan-duct system for Air conditioning application	4
CO5: Understand and appreciate the individual components of an automobile Air conditioning system. various HVAC system components for various applications in the building requirements	2
CO6 : Apply the advanced knowledge and technical skills of air Conditioning system for the design of air conditioning equipments	4

Course Contents

Unit I	**Psychrometryand Air Conditioning Processes**	**(08 Hrs)**

Moist Air properties, use of Psychrometric Chart, Various Psychrometric processes, Air Washer, Adiabatic Saturation. Summer and winter Air conditioning, Enthalpy potential and its insights

Unit II	**Load Estimation**	**(08Hrs)**

Thermal comfort – Design conditions – Solar Radiation-Heat Gain through envelopes – Infiltration and ventilation loads – Internal loads – Procedure for heating and cooling loadestimation.

Unit III	**Air Conditioning Systems**	**(08Hrs)**

Thermal distribution systems – Single, multi zone systems, terminal reheat systems, Dual duct Systems, variable air volume systems, water systems and Unitary type systems.

Unit IV	**Air Distribution And Control**	**(09 Hrs)**

Flow through Ducts , Static & Dynamic Losses , Diffusers , Duct Design–Equal Friction Method, System Balancing , Fans & Duct System Characteristics , Fan Arrangement Variable Air Volume systems, Air Handling Units and Fan Coil units – Control of temperature, humidity, air flow and quality.

Unit V	**HVAC System In Automobiles**	**(09 Hrs)**

Automotive System layout and Components- Commonly used Refrigerants- Safety devices – Climate control – Fuel efficiency aspects

Books

Reference Books:

1. Arora C.P., Refrigeration and Air Conditioning, Tata McGraw Hill Pub. Company, 2010.
2. ASHRAE, Fundamentals and equipment , 4 volumes-ASHRAE Inc. 2005.Carrier Air Conditioning Co., Handbook of Air Conditioning Systems design, McGrawHill, 1985.
3. Dossat Ray J, Principles of refrigeration, S.I. version, Willey Eastern Ltd, 2000.
4. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982
5. Norman C. Harris, “Modern Air Conditioning”, New York, McGraw-Hill,1974
6. Kuehn T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998
7. Manohar Prasad, Refrigeration and Air Conditioning, Willey Eastern Ltd, 1983

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	3	2	3	3
CO2	1	1	2	2	3	2	3	3
CO3	2	1	2	2	2	2	3	3
CO4	2	1	1	2	2	2	3	3
CO5	1	1	1	2	2	2	3	3
CO6	2	1	1	2	2	2	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1412-D: Alternate Fuels For IC Engines

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite:

Companion Course, if any: -

Course Objectives:

1.To expose potential alternate fuels and their characteristics
2 To use appropriate synthetic fuels and fuel additives for better combustion characteristics
3 To utilize alcohol fuels effectively for lower emissions
4 To elaborate on the utilization of Bio-Diesel and its types as a suitable fuel in CI engines
5 To utilize different gaseous fuels and predict their performance and combustion characteristics

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1:Expose potential alternate fuels and their characteristics	2
CO2:Use appropriate synthetic fuels and fuel additives for better combustion characteristics	3
CO3:Utilize alcohol fuels effectively for lower emissions	3
CO4:Elaborate on the utilization of Bio-Diesel and its types as a suitable fuel in CI engines	2
CO5:Utilize different gaseous fuels and predict their performance and combustion characteristics	3
CO6:Analyse, interpret and provide solutions to real life fuel related problems	4

Course Contents

Unit I	**Introduction**	**(08 Hrs)**

Availability, Suitability, Properties, Merits and Demerits of Potential Alternative Fuels – Alcohols, Biodiesel, Hydrogen, Liquefied Petroleum Gas, Natural Gas, Biogas, Fuel standards – ASTM & EN

Unit II	**Special And Synthetic Fuels**	**(09 Hrs)**

Different synthetic fuels, Merits, and demerits, Dual, Bi-fuel and Pilot injected fuel systems, Fuel additives – types and their effect on performance and emission characteristics of engines, Flexi-fuel systems, Ethers - as fuel and fuel additives, properties and characteristics.

Unit III	**Alcohol Fuels**	**(10 Hrs)**

Alcohols – Properties, Production methods and usage in engines. Blending, dual fueloperation, surface ignition, spark ignition and oxygenated additives. Performance, combustionand emission Characteristics in engines. Issues & limitation in alcohols

Unit IV	**Bio-Diesel Fuels**	**(09 Hrs)**

Vegetable oils and their important properties. Fuel properties characterization. Methods ofusing vegetable oils – Blending, preheating, Transesterification and emulsification –Performance, combustion and emission characteristics in diesel engines. Third generationbiofuels, Ternary and Quaternary fuels, Issues & limitation of using vegetable oils in ICengines		
Unit V	**Gaseous Fuels**	**(09 Hrs)**
Biogas, Natural gas, LPG, Hydrogen – Properties, problems, storage and safety aspects. Methods of utilisation in engines. Performance, combustion and emission characteristics in engines. Issues & limitation in Gaseous fuels		
Books		
Reference Books: **1.** Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990. **2.** Pundir B.P, I.C. Engines Combustion and Emission, 2010, Narosa Publishing House. **3.** Richard L. Bechtold, Automotive Fuels Guide Book, SAE Publications, 1997		
@The CO-PO Mapping Matrix		

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	2	2	3	2	3	3
CO2	1	1	2	2	3	3	3	3
CO3	2	1	2	2	2	2	3	3
CO4	2	1	1	2	2	3	3	3
CO5	1	1	1	2	2	3	3	3
CO6	2	1	1	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1412-E: Generic Elective (GE)

TeachingScheme	Credit	ExaminationScheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1413: Thermal Engineering lab-II

Teaching Scheme:	Credit	Examination Scheme:
PR: 04 Hours/Week	02	In_Sem: 40 Marks End_Sem: 60 Marks Total: 100 Marks

Companion Course: Advanced Heat Transfer and Design of Heat Exchanger

Learning Objectives:

The course intends to provide opportunity to student for performing actual experiments on heat transfer mechanism and related phenomenon.

Course Outcomes: On completion of the course, learner will be able to–	BL
CO1:- UnderstandFundamental of heat transfer problems	2
CO2: -Apply theNatural and Forced Convection heat transfer	3
CO3: -AnalyseBoiling and Condensation heat transfer	4
CO4: - Design the heat exchangeron basis of given thermal load.	4
CO5: - Design the Heat transfer augmentation Technique	4
CO6:- Able to identify, select and apply appropriate techniques, resources and state of the art tools to model, analyze and solve problems in the area of thermal science	4

Lab Experiments / Assignments (Any Five)

CO Mapping: CO1 to CO5 for all Lab Assignments

Sr. No.	Problem Statement	CO Mapping
1.	Transient Heat Conduction using Heisler and Grober charts	1 & 6
2.	Combined Natural and Forced Convection heat transfer.	2& 6
3.	Assignment on Boiling and Condensation	3& 6
4.	Heat transfer augmentation Technique.	4& 6
5.	Study of plate heat exchanger	5& 6
6.	Experimentation on any one Heat exchanger	5& 6

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	2	2	2	3	2	2	3	3
CO.2	2	2	2	2	2	3	3	3
CO.3	2	2	2	2	2	2	3	3
CO.4	2	1	1	2	2	3	3	3
CO.5	1	2	1	2	2	3	3	3
CO.6	2	1	1	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1414: Elective Lab -II

Teaching Scheme:	Credit	Examination Scheme:
PR: 04 Hours/Week	**02**	**InSem: 40 Marks** **End_Sem: 60 Marks** **Total: 100 Marks**

Syllabus Contents:

- The lab practice consists of the tutorials / experiments / Case Study / industrial visit / Industry base Mini project related to thermal systems as decided by the course supervisors of the Program Elective Core Lab (PECL) as follows
  1. Battery Thermal Management System
  2. Environmental Engineering And Pollution Control
  3. Air Conditioning Systems
  4. Alternate Fuels For IC Engines
  5. Generic Elective (GE)

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1415: Project and Finance Management

Teaching Scheme	Credit	Examination Scheme
TU: 01 Hours/Week **PR: 02 Hours/Week**	**02**	**In_Sem: 20 Marks** **End_Sem: 30 Marks** **Total: 50 Marks**

Course Objectives:

1.Identify the strategies involved in selection, prioritization, planning and scheduling of a project

2.Analyze project risk, progress & results

3.Make awareness about various sources of finance

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1:Understand the selection, prioritization and initiation of individual projects,WBS, scheduling, uncertainty and risks associated in project	2
CO2: Outline the progress and results of the project and illustrate the time value of money and use it for decision making.	3
CO3 : Identify the capital requirements for starting a business and management of working capital	3
CO4 :Apply the knowledge of Project finance and Budgets	3
CO5 :Apply the knowledge of Capital management involved in projects development	3
CO6:Apply principles of project management, finance, and capital management to effectively plan, execute, and evaluate engineering projects.	3

Course Contents

Unit I	**Introduction**	**(04Hrs)**

Project Management: Definition of project, characteristics of projects, types of projects, project roles.

Project Selection & Prioritization: Strategic planning process, strategic objectives, identifying potential projects, feasibility study (environment, society), methods of selecting projects, prioritizing projects, securing and negotiating projects

Unit II	**Project Planning**	**(04Hrs)**

Project planning and scheduling: Project scope and check list, work breakdown structure, project schedule, and uncertainty in project schedules.

Project resourcing and risk planning: Abilities needed when resourcing projects, estimate resource needs, cost planning and estimating, risk management planning, risk identification, risk analysis, project quality planning and project kick-off.

Unit III	**Project performing**	**(04Hrs)**

Project performing, progress & results: Project supply chain management, project balanced score card approach, terminate project early, finish project, customer feedback & approval.

Unit IV	**Project Management and Capital Budgeting**	**(05Hrs)**

Financial Management: Evolution of financial management, key activities of finance manager, key decision areas in financial management, financial statement with balance sheet. Efficient utilization and generation of monetary resources and funds, a comparative study of finance and economics, Costs and revenue evaluation for various engineering operations.

Capital Budgeting: Types of capital budgeting decisions, capital budgeting proposals, estimating cash flows for project appraisal, green capital budgeting

Unit V	Capital Management	(05Hrs)

Working capital management: Factors affecting working capital requirement, operating cycle analysis, negative working capital, cash planning and managing cash flows.

Cost of capital and leverage Analysis: Concept, significance, assumptions, factors affecting cost of capital, Leverage Analysis: operating leverage, financial leverage

Books

Text Books:

1.Timothy J Kloppenborg, Project Management, Cengage Learning, 2nd Edition, 2009.

2. John J Hampton, Financial Management, PHI Publication, 4th edition

Reference Books:

1.Pennington Lawrence, Project Management, McGraw-Hill, 1st edition.

2. Joseph A Moder, Philips New Yark, Project Management with CPM & PRT, McGraw-Hill, 2nd edition, 1983

3. M.Y. Khan, Financial Management, Tata Mc-Graw Hill, Fifth Edition, 2007.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	-	3	2	-	-	-
CO2	1	2	-	2	2	3	-	-
CO3	1	2	-	2	2	2	-	-
CO4	1	1	-	2	2	3	-	-
CO5	1	1	-	2	2	3	-	-
CO6	1	1	-	2	2	3	-	-

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1416: Human Rights

Teaching Scheme	Credit	Examination Scheme
TU: 02 Hours/Week	**02**	**CAT/CCE: 20 Marks** **End Sem: 30 Marks** **Total: 50 Marks**

Course Objectives:

- To help students understand how human rights are protected under Indian criminal lawsand the Constitution.
- To teach the role of police, courts, jails, and legal aid in protecting human rights.
- To discuss problems like custodial violence and suggest ways to improve justice and protect vulnerable groups.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: Understand the Constitutional Framework for Human Rights	**2**
CO2: Evaluate legal and constitutional protections against torture and inhumane treatment	**4**
CO3: Apply Human Rights Norms to Criminal Justice Practices	**3**
CO4: Analyze the Need for Reformation of Jail Manuals and Prison Rules	**3**
CO5: Understand the Right to Free Legal Aid for Disabled Persons and Judicial Responses	**2**
CO6: Understand Theories of Punishment	2

Course Contents

Module #1

Constitutional mechanism for enforcement of Human Rights, Role of Supreme Court under the constitution of India, Role of High Court, Role of Subordinate judiciary, Public Interest Litigation, Origin and development of Legal Aid, Related provision of Legal Aid under the Indian Laws, Human Rights under the Preventive Detention Laws

Module #2

Safeguard against other General and Special Criminal Laws, Right against Arbitrary Arrest, Right against Torture, , Right of Accused Person , Right to Legal Aid and assistant for the accused person, Emergency provision under the constitution, International standard norms of Human Rights during Emergency, Judicial responses to the protection of Human Rights during the Emergency

Module #3

Rights of detenues under the Indian Laws, Protection of Human Rights for Male prisoners, Protection of Human rights for Women Prisoners, Judicial approach to protection of prisoner's rights, Nature and scope of criminal justice system in India, Administration of justice and the role of the court, Justice delivery system under the criminal laws, Protection of accused person under the Indian Laws

Module #4

Role of police under the criminal Laws, Importance of investigation in criminal justicing system, law enforcement agencies and custodial crimes against men, Law enforcement agencies and custodial crime against women and children, Theories of Punishments, Importance of Jail, Reformation of Jail

manuals and rules, Importance of Juvenile homes in India.

Module #5

Reformation of Juvenile Homes, Protection of Women Rights under the criminal Laws of India, Protection of Women Rights under the International Law, , Protection of Child Rights under the criminal Laws of India, Protection of child rights under the International law, Meaning and definition of disabled person and their legal status, Disability and Human Rights: National and International Perspectives, Right to free Legal Aid of the disable people and judicial response to their problem

Learning Resources

Text Books:

1. HANDBOOK OF HUMAN RIGHTS AND CRIMINAL JUSTICE IN INDIA P: Third Edition
2. "Human Rights And Criminal Justice" by Pandit Kamalakar

Reference Books:

1.Criminal Justice: A Human Rights Perspective of the Criminal Justice Process in India by Dr. K.I. Vibhute

e-Books:

1.https://nhrc.nic.in/sites/default/files/I-%20BOOK.pdf

2. https://nhrc.nic.in/sites/default/files/HREdu.pdf

MOOC Courses:

https://onlinecourses.swayam2.ac.in/cec20_hs24/preview

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	-	1	1	-	-	-	-	-
CO2	-	1	1	-	-	-	-	-
CO3	-	1	1	-	-	-	-	-
CO4	-	1	1	-	-	-	-	-
CO5	-	1	1	-	-	-	-	-
CO6	-	1	1	-	-	-	-	-

SEMESTER-III

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1417: MOOC-3Cyber Security

Teaching Scheme	Credit	Examination Head:TH Examination Scheme & Marks
TH:04 Hours/Week	04	ISE: CAT:20 Marks CCE:20 Marks ESE:60 Marks

Prerequisite:

Companion Course, if any:

Course Objectives:

- To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks.
- To develop students that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.
- To develop graduates that can identify, analyze, and remediate computer security breaches

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: Analyze and evaluate the cyber security needs of an organization.	**4**
CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.	**3**
CO3: Analyze logs to correlate events and identify patterns that indicate threats.	**4**
CO4: Demonstrate cryptographic methods ensure secure communication and data protection.	**3**
CO5:Identify and collect digital evidence in a forensically sound manner.	**1**
CO6: Apply ethical and legal principles in the handling and investigation of digital evidence.	**3**

Course Contents

Unit I	**Overview of Cyber Security**	**(08 Hrs.)**
Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace. Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.		
Case Study	Discuss Cyber security in Financial Sector	
Unit II	**Vulnerabilities and Access Control**	**(08 Hrs.)**
Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.		
Case Study	Discuss Vulnerabilities in E-Commerce - Securing Customer Data at Shop Now	
Unit III	**Intrusion detection and Prevention**	**(08 Hrs.)**

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.		
Case Study	Intrusion Detection and Prevention in Financial Sector - Safeguarding Bank Data at Secure Bank.	
Unit IV	**Cryptography**	**(08 Hrs.)**
Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls-Types of Firewalls, User Management, VPN Security Protocols: - security at the Application Layer-PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPsec**.**		
Case Study	Discuss Cryptography in Secure Cloud Storage - Protecting Data at Cloud Secure	
Unit V	**Cyber Forensic**	**(08 Hrs.)**
Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.		
Case Study	Discuss Cyber Forensics in Intellectual Property Theft	
Learning Resources		
Text Books: 1. The Hacker Playbook: Practical Guide to Penetration Testing – @Peter Kim. 2. Applied Network Security Monitoring: Collection, Detection, and Analysis – @Chris Sanders, @Jason Smith.		
Reference Books: 1. Network Security Through Data Analysis: Building Situational Awareness – Michael Collins.		
e-Books: <web links> 1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf 2.http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-Behavior.pdf 3. http://docshare04.docshare.tips/files/21900/219006870.pdf		
MOOC Courses: <web links> 1. https://swayam.gov.in/nd2_cec20_cs15/preview		

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1418:Computational Fluid Dynamics

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Fluid mechanics

Companion Course, if any: Thermal Engineering Lab-III (24P1419)

Course Objectives:

1.To Understand the concept of fluid dynamics, CFD techniques, convergence criteria

2.To familiarize the students about the implementation of CFD in fluid mechanics and heat transfer problems

3.To understand the use of software based on CFD

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: -Understand the stepwise procedure to completely solve a fluid dynamics problem Using computational methods.	2
CO2:-.Identify applications of finite volume and finite element methods to solve Navier-Stokes equations	3
CO3: -Analyze various methods of grid generation techniques and application of finite difference and finite volume methods to various thermal problems	4
CO4: -Design and setup flow problem properly within CFD context, performing solid using CAD package and producing grids via meshing tool.	3,4
CO5: -Use CFD software to model relevant engineering flow problems. Analyze the CFD results. Compare with available data, and discuss the findings**.**	3,4
CO6:- Extend and implement new thoughts on fluid machinery with the aids of modern CFDwhile ensuring best thermal analysis practices.	3

Course Contents

Unit I	**Introduction to CFD**	**(08 Hrs)**
Introduction: History and Philosophy of computational fluid dynamics, Computational approach to Fluid Dynamics and its comparison with experimental and analytical methods, Basics of PDE: Elliptic, Parabolic and Hyperbolic Equations, Applications of CFD in engineering		
Unit II	**Governing equations**	**(08 Hrs)**
Review of Navier-Stokes Equation and simplified forms, Solution Methodology: FDM and FVM with special emphasis on FVM, Stability, Convergence and Accuracy.		
Unit III	**Discretization and Essentials of Numerical Methods**	**(10 Hrs)**

Finite Difference Method: Introduction, finite difference approximations, Taylor series expansion, polynomial fitting, approximation of boundary conditions, applications to conduction and advection-diffusion problems

Finite Volume Method: Basic methodology, finite volume discretization, approximation of surface and volume integrals, interpolation methods – central, upwind and hybrid formulations and comparison for convection-diffusion problem

Unit IV	**Geometry Modeling and Grid Generation**	**(10 Hrs)**

Practical aspects of computational modelling of flow domains, Grid Generation, Types of mesh and selection criteria, Mesh quality, Key parameters and their importance.Structured Grid Generation: Algebraic Methods,PDE Mapping Methods, Surface Grid GenerationUnstructured Grid Generation:Delaunay-VoronoiMethods,Advancing Front Methods,Combined DVM and AFM

Unit V	**Turbulence Modeling**	**(8 Hrs)**

Reynolds averaged Navier-Stokes equations, Turbulence Models: Zero-Equation Models, One-Equation Models, Two-Equation Models. Second Order Closure Models (Reynolds Stress Models) ,Algebraic Reynolds Stress ModelLarge Eddy Simulation, Direct Numerical Simulation, Turbulence Models for Reynolds Averaged Navier-Stokes(RANS),

Books

Text Books:

1. Anderson, J.D., "Computational Fluid Dynamics", McGraw Hill Publications , 2017
2. Anil W. Date, "Introduction to Computational Fluid Dynamics", Cambridge Univ. Press,

Reference Books:

1. Chung, T.J. "Computational Fluid Dynamics", Cambridge University Press; 2nd edition, 2014
2. S.V. Patankar, "Numerical Heat Transfer and Fluid Flow",Hemisphere Publishing Corporation

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	1	2	1	3	2	2	3	3
CO2	1	1	1	2	2	3	3	3
CO3	2	1	2	2	2	2	3	3
CO4	3	1	1	2	2	3	3	3
CO5	3	1	2	2	2	3	3	3
CO6	3	1	2	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1419-A:Cogeneration And Waste Heat Recovery Systems

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	04	CAT: 20 Marks CCE: 20 Marks End Sem: 60 Marks Total: 100 Marks

Prerequisite:

Course Objectives:

1. To analyze the basic energy generation cycles.
2. To detail about the concept of cogeneration, its types and probable areas of applications.
3. To study the significance of waste heat recovery systems and carry out its economic analysis.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO.1 Understands the principles of cogeneration systems.	2
CO.2. Understand the principles of cogeneration technology.	2
CO.3. Understand the of Issues And Applications Of Cogeneration Technologies	2
CO.4. Understand The Waste Heat Recovery Systems.	2
CO.5.Understand the Economic Analysis.	2
CO.6.Apply Knowledge of Cogeneration And Waste Heat Recovery Systems for practical Application.	3

Course Contents

Unit I	Introduction	(08 Hrs)

Introduction – principles of thermodynamics – cycles – topping – bottoming – combined cycle – organic ranking cycles – performance indices of cogeneration systems – waste heat recovery – sources and types – concept of tri and quad generation

Unit II	Cogeneration Technologies	(09 Hrs)

Configuration and thermodynamic performance – steam turbine cogeneration systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems – combined cycles cogeneration systems – advanced cogeneration systems: fuel cell, Stirling engines etc.

Unit III	Issues And Applications Of Cogeneration Technologies	(10 Hrs)

Cogeneration plants electrical interconnection issues – utility and cogeneration plant interconnection issues – applications of cogeneration in utility sector – industrial sector –building sector – rural sector – impacts of cogeneration plants – fuel, electricity and environment

Unit IV	Waste Heat Recovery Systems	(09 Hrs)

Selection criteria for waste heat recovery technologies – recuperators – Regenerators –economizers – plate heat exchangers – thermic fluid heaters – Waste heat boilers –classification, location, service conditions, design Considerations – fluidized bed heatexchangers – heat pipe exchangers – heat pumps – sorption systems

Unit V	Economic Analysis	(09 Hrs)

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

Books

Reference Books:

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.
2. De Nevers, Noel, Air Pollution Control Engineering, McGraw Hill, New York,1995.
3. EDUCOGEN – The European Educational tool for cogeneration, Second Edition, 2001.
4. Energy Cogeneration Hand book, George Polimveros, Industrial Press Inc, New yark1982.
5. Horlock JH., Cogeneration - Heat and Power, Thermodynamics and Economics,Oxford,1987.
6. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers,London,1963.
7. Seagate Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere,Washington, 1983

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	1	2	2	3	3	2	3	3
CO.2	1	1	2	2	3	2	3	3
CO.3	2	1	2	2	2	2	3	3
CO.4	2	1	1	2	2	2	3	3
CO.5	1	1	1	2	2	2	3	3
CO.6	2	1	1	2	2	2	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1419-B Gas turbineand Jet Propulsion

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: Students are expected to have a good understanding of basic internal Combustion Engine.

Companion Course, if any: -

Course Objectives:

This course will enable students to understand fundamental knowledge of construction and working of various types of gas turbines and Jet Propulsion andtheir components.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO.1 Analyze thermodynamic cycles of steam turbine and understand construction, working and significance of its various components	4
CO.2 Analyze thermodynamic cycles of Centrifugal Compressor	4
CO.3 Explain Axial Flow Compressor	2
CO.4 Describe in detail about Combustion in turbine.	2
CO.5 Analyze the jet propulsion	4
CO.6Apply concepts of Combustion and thermal-fluid sciences on Gas turbine and Jet Propulsion to solve engineering problems utilizing advanced technology.	3

Course Contents

Unit I	**Gas Turbine Plant**	**(08 Hrs)**

Gas Turbine Plant: Historical review. Thermodynamic analysis of practical gas turbine cycles. The turboprop engine. The compressor, combustor, turbine and exhaust nozzle characteristics. Performance characteristics of the stationary and turboprop and turbojet engine. The turbojet engine components. Specific thrust and overall efficiency. Static and flight performance at the design point

Unit II	**Centrifugal Compressors**	**(09 Hrs)**

Principal of operation, work done and pressure rise. Vaneless space, slip factor, power input factor and Mach number at intake to impeller.

Unit III	**Axial Flow Compressor**	**(10 Hrs)**

Principle of operation, velocity triangles. Design procedure for single and multistage compressors. Three-dimensional effect compressor performance. Description and problems of transonic and supersonic compressors.

Unit IV	**Combustion in Gas Turbine**	**(09 Hrs)**

Problem to be faced in the design of gas turbine combustion systems. Fuel injection system. Combustion chamber designs. Pressure loss. Temperature distribution, Reaction time, Flame stabilization.

Unit V	Jet Propulsion	(09 Hrs)
Ideal and Non-ideal cycle analysis, Diffusers, Nozzles, Combustors and Afterburners, Ducts and Mixers, System matching and analysis, Rocket Propellants, rocket equation, rocket staging, electric propulsion.		

Books

Text Books:

1. V. Ganesan "Gas Turbine" Tata McGraw-Hill Education, 2nd edi. ,2003

Reference Books:

1. Elements of Gas Turbine Propulsion – Jack D. Mattingly , Tata Mc-Graw Hill
2. Fundamentals of Jet Propulsion with Applications, Ronald D. Flack, Cambridge University
3. Cohan, Rogers "Gas Turbine" Person, 5th edition. ,2001
4. Dr.Meherwan P. Boyce, P.E "Gas Turbine Engineering" Handbook, 3rd edition, 2011

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	1	2	2	2	3	2	3	3
CO.2	1	1	2	2	3	3	3	3
CO.3	1	1	2	2	2	2	3	3
CO.4	1	1	1	2	2	3	3	3
CO.5	1	1	1	2	2	3	3	3
CO.6	2	1	1	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1419-C: Cryogenics Engineering

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite: **S**tudents are expected to have a good understanding of Thermodynamics, Fluid Mechanics, Refrigeration and Air Conditioning, Heat Transfer, Mathematics

Course Objectives:

1. To enable the students to analyze and solve cryogenics related problems by applying principles of mathematics, science and engineering.
2. To prepare students to use modern tools, techniques and skills to fulfill industrial needs related to low temperature systems.
3. To train students with effective communication skill to demonstrate cryogenics theories.
4. To develop skills in the analysis of cryogenics systems in research or design.
5. To develop a professional approach to lifelong learning in the refrigeration/air conditioning/cryogenics to include the awareness of social and environment issues associated with engineering practices

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: Apply knowledge of mathematics, science, and engineering for the needs in Cryogenic.	**3**
CO2: Explain the concept of various liquefaction cycles and systems for air, hydrogen and Helium gas.	**2**
CO3: Understand the concept of Gas separation and purification for air and hydrogen	**2**
CO4: Describe the idea of Cryocoolers Cryogenic refrigeration systems	**2**
CO5: Explain the concept of Cryogenic fluid storage system and importance of Instrumentation and safety required in cryogenics to measure Flow, Level and temperature	**2**
CO6. Apply Knowledge of Cryogenics Engineering for advanced air conditioning system.	**3**

Course Contents

Unit I	**Cryogenic fluids and applications**	**(08 Hrs)**
Introduction, properties of cryogenic fluids, properties of materials used in cryogenics at lower temperature, superconductive materials, applications of cryogenics Cryogenic fluids and applications		
Unit II	**Gas Liquefaction**	**(09 Hrs)**
Gas liquefaction & refrigeration systems, Basics of refrigeration & liquefaction, ideal thermodynamic cycle, Joule Thomson effect, adiabatic expansion, various liquefaction cycles, Liquefaction systems for air, Neon, Hydrogen & Helium gas		
Unit III	**Gas Separation and Purification**	**(10 Hrs)**
Gas separation and purification – principles, Gas separation systems for air, hydrogen		
Unit IV	**Cryocoolers**	**(09 Hrs)**

Cryocoolers Cryogenic refrigeration systems, Ideal and practical systems, Joule-Thompson cryocoolers, Stirling Cycle Refrigerators		
Unit V	**Cryogenic fluid storage and transfer systems**	**(09 Hrs)**
Cryogenic fluid storage and transfer systems Cryogenic Dewar, Cryogenic Transfer Lines, Two phase flow in cryogenic transfer system. Instrumentation and safety Instrumentation: in cryogenics to measure Flow, Level and Temperature		

Books

Reference Books:

1. Thomas M. Flynn, "Cryogenic Engineering", Marcel Dekker. Inc New York illustrated edition 1997.
2. Marshall Sittig, D. Van Nostrand Co. "Cryogenics - Research and Applications", Princeton N.J, Van Nostrand. 1963Scott,
3. R. B, Cryogenic Engineering, Scott, R. B. D'Van-Nostrand, 1962.
4. Vance, R. W., Applied Cryogenic Engineering, John Wiley and sons, 1st edition1962.
5. M. Sitting, "Cryogenic", D' Van-Nostrand company, 1st edition 1963.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	2	2	3	2	1	3	3
CO2	2	2	2	2	2	3	3	3
CO3	2	2	2	2	2	2	3	3
CO4	2	1	1	2	2	3	3	3
CO5	1	1	1	2	2	3	3	3
CO6	2	2	2	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1419-D: Advanced Power Plant Engineering

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

Prerequisite:

Course Objectives:

1. Understand the thermodynamics associated with power plants
2. Detail on the role of various utilities in coal based thermal power plants
3. Acquire know-how on the working of gas turbine and diesel power plants
4. Appreciate the concept of Poly generation for total energy recovery from a system
5. Brief on the working of hydro electric and nuclear power plants

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO.1Analyse appropriate power generation technologies for mitigating the energy gap	4
CO.2. Appraise the steam rate, heat rate and cost for generating electricity from coal based thermal power plants	3
CO.3 Analyze and suggest measures for improving the performance of gas turbine and diesel power plants	4
CO.4. Assess the applicability and performance of a cogeneration system	3
CO.5. Decide a suitable type of hydroelectric/nuclear power plant commensurate with the prevailing conditions	2
CO.6. Apply Knowledge of different Power Plants for economic power generation with different load	3

Course Contents

Unit I	**Introduction**	**(08 Hrs)**

Energy scenario: India Vs. World – Load curves and–thermodynamic analysis of Conventional Power Plants (Coal, Gas Turbine and Diesel)-Advanced Power Cycles-Kalina Cycle, IGCC.

Unit II	**Coal Based Thermal Power Plants**	**(09 Hrs)**

Basics of typical power plant utilities – Boilers, Nozzles, Turbines, Condensers, Cooling Towers, Water Treatment and Piping system – steam rate and heat rate – mean temperature of heat addition-Rankine cycle improvements–Superheat, Reheat, Regeneration, Supercritical, AFBC/PFBC – computation of per unit cost of power generation from coal/biomass

Unit III	**Gas Turbine And Diesel Power Plants**	**(10 Hrs)**

Brayton cycle – Open and Closed – Improvements – Intercooler, Reheating and Regeneration.
Diesel power plant – Layout – Performance analysis and improvement – Techniques forstarting, cooling and lubrication of diesel engines-computation of per unit cost of powergeneration

Unit IV	**CHP And MHD Power Plants**	**(09 Hrs)**

Cogeneration systems–types-heat to power ratio-Thermodynamic performance of steam turbine gas turbine and IC engine-based cogeneration systems–Poly Generation-Binary Cycle-Combined cycle. MHD –Open cycle and closed cycle-Hybrid MHD & steam power plants

Unit V	**Hydro Electric and Nuclear Power Plants**	**(09 Hrs)**

Hydroelectric Power plants – classifications – essential elements – pumped storage systems – micro and mini hydel power plants. General aspects of Nuclear Engineering – Components of nuclear power plants – Nuclear reactors & types – PWR, BWR, CANDU, Gas Cooled, Liquid Metal Cooled and Breeder reactor-nuclear safety–Environmental Issues-Computation of per Unit cost of power generation

Books

Reference Books:

1.Nag, P.K., Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd, New Delhi,1998.
2. E.I.Wakil, Power Plant Engineering, McGraw Hill Publications New Delhi
3. Wood, A.J., Wollen berg, B.F., Power Generation, operation and control, John Wiley, NewYork,1984.
4. Gill, A.B., Power Plant Performance, Butter worths,1984.
5. Lamarsh, J.R., Introduction to Nuclear Engg. 2nd edition, Addison-Wesley, 1983
6.R.Yadav , Steam and Gas Turbines ,Central Publishing House, Allahabad.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	2	2	2	3	2	3	2	1
CO.2	2	1	2	2	2	3	2	2
CO.3	2	1	2	2	2	2	2	1
CO.4	2	2	1	2	2	3	2	2
CO.5	1	1	1	2	2	3	2	2
CO.6	2	1	1	2	2	3	2	2

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1419-E: Generic Elective (GE)

TeachingScheme	Credit	ExaminationScheme
TH: 04 Hours/Week	**04**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1420: Thermal Engineering Lab -III

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 Hours/Week	01	InSem: 20 Marks End_Sem: 30 Marks Total: 50 Marks

Companion Course: -Computational Fluid Dynamics

Learning Objectives: Understanding advanced concepts in fluid mechanics such as Navier-Stokes equations, boundary layer theory, turbulence modeling, and compressible flow. Learning various experimental techniques used in fluid mechanics research, including flow visualization, pressure measurement, velocity measurement

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO.1 Understand the Bernoulli's theorem for governing fluid flows	2
CO.2 Calculate the buoyancy force	3
CO.3 Calculate the different fluid properties Density	3
CO.4 Understand the properties and characteristics of incompressible fluid:	2
CO.5 Calculate hydrostatic force and use of law of conservation mass to fluid flow	3
CO.6Apply Knowledge of CFD for different application	3

Suggested List of Laboratory Experiments/Assignments(Any 5 laboratory assignments)

CO Mapping: CO1 to CO5 for all Lab Assignments

Sr. No.	Problem Statement	CO Mapping
1.	Experimentation on External flow over a 2D/3D	1 &6
2.	Estimation Flow over a cylinder/sphere at different Re. Pressure variation over the body and drag	2 & 6
3.	Thermal Analysis of solar flat plate collector	3& 6
4.	Thermal Analysis of solar air heater	4& 6
5.	Flow past an aerofoil: Pressure measurements, calculation of lift	5& 6
6.	Flow through a square duct and characterization for turbulence intensity	5& 6

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	2	2	2	3	3	2	3	3
CO.2	2	1	2	2	3	3	3	3
CO.3	2	1	2	2	2	2	3	3
CO.4	2	1	2	2	2	3	3	3
CO.5	2	1	1	2	2	3	3	3
CO.6	2	1	1	2	2	3	3	3

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1421: Company Law and Corporate Governance

Teaching Scheme	Credit	Examination Scheme
TU: 01 Hours/Week	01	In_Sem: 20 Marks End_Sem: 30 Marks Total: 50 Marks

Prerequisite:

Course Objectives:

The course is designed to understand the formation, management and other activity of the companies. In view of the changing facts of global governance corporate governance plays a vital role in the development of an economy both national and international level

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1:- Identify and explain the key characteristics, historical background, and various types of companies, as well as evaluate the merits and demerits of company incorporation.	2
CO2:- Describe the role of promoters, outline the legal aspects of pre-incorporation contracts, and analyze the components and implications of the Memorandum and Articles of Association, including doctrines related to them	2
CO3:- Evaluate the formalities and issues related to the issuance of prospectuses, analyze the types and characteristics of shares and debentures, and assess the implications of share capital and borrowing powers	4
CO4:-Analyze the significance, objectives, and dimensions of corporate governance, and evaluate the reasons for governance failures and initiatives for strengthening corporate governance.	4
CO5: Examine the model workings of corporate governance, including the roles and responsibilities of directors and shareholders, and assess the effectiveness of governance structures and independent directors in the Indian context.	4
CO6: Evaluate and analyze key aspects of corporate structures, governance, and legal frameworks to assess their impact on company performance and compliance	4

Course Contents

Unit I	Company and its Nature and Scope	(04 Hrs)

- Meaning, Definition and characteristics of company.
- Historical background of company
- Kinds of companies
- Merits and Demerits of Incorporation of company - Lifting the corporate veil

Unit II	Procedure for Incorporation of companies	(04 Hrs)

- Role of promoters, Legal Position of Promoter Pre-incorporation contracts
- Memorandum of Association - Meaning, Purpose, Contents, Ultravires and Doctrine of Ultravires
- Articles of Association - Meaning Purpose, Content. Alternation, Constructive Notice.
- Doctrine of Indoment Exceptions

Unit III	Prospectus, Shares and Debentures	(4 Hrs)

- Meaning - Formalities of issue Prospectus - Misrepresentation of Prospectus -
- Golden Rule
- Shares - Meaning, Types of Shares and Transfer of shares
- Share Capital, Meaning, Kinds, Alternation, Reduction and Voting Rights
- Debenture - Meaning, Types, Charge-Fixed and Floating, Crytalisation of Floating charge
- Borrowing Powers - Effective of unauthorized borrwoings

Unit IV	Introduction to Corporate Governance	(04 Hrs)

- Introduction, Meaning and definition of CG, Significance objectives of CG, Dimensions of CG benefits of CG,issues in CG
- Reasons for corporate Governance Failure, Certain new
- initiatives in Governance, consequences of bad Governance, requirements to strengthen Corporate Governance

Unit V	Model working of corporate governance	(04 Hrs)

- Model working of corporate governance: Board Structure, role and responsibilities of directors, Rights
- Responsibilities of shareholders, ownership of independent
- Directors – Indian Scenario, corporate governance summary, corporate governance rating

Books

Reference Books:

1 A.K. Mujumdar, Dr. G.K. Kapoor, Company Law and Practice; Taxmann, 59/32, New Rohtak Road, New Delhi-110 005.

2.C.A.KamalGarg, Bharat's Corporate and Allied Laws, 2013

3.Institute of Company Secretaries of India, Companies Act 2013, CCH WolterKluver Business, 2013

4. Lexis Nexis, Corporate Laws 2013 (Palmtop Edition)

5.Avtar Singh : Company Law

6.C. Fernando, Business Ethics and Corporate Governance Pearson.

7.V.Balachandran V.Chandrasekaran, Corporate Governance Ethics and Social Responsibility, PHI Publication

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO.1	-	1	-	-	-	1	-	-
CO.2	-	1	-	-	-	1	-	-
CO.3	-	-	-	-	-	1	-	-
CO.4	-	-	-	-	-	1	-	-
CO.5	-	-	-	-	-	1	-	-
CO.6	-	1	-	-	-	1	-	-

Matoshri College of Engineering & Research Centre, Nashik Master of Technology in Heat Power Engineering 2024-25 Second Year MTech Heat Power Engineering 24P1422:Dissertation Stage-I		
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 12 Hours/Week	**06**	**CCE 1: 40 Marks** **CCE 2: 40 Marks** **End_Sem: 120 Marks** **Total: 200 Marks**

Prerequisite:Nil

Course Objectives:

1. To learn the literature survey
2. To familiarize the students about understanding the open literature, preparation of literature review
3. To understand the problem formulation based on the literature review

Course Outcomes: On completion of the course, learner will be able to -	**BL**
CO1: - Identify a topic in advanced areas of Thermal Engineering.	2
CO2: -Review literature to identify gaps and define objectives and scope of the work.	2
CO3: - Select the specific problem or ideas from literature and develop research methodology.	3
CO4: - Develop a model, experimental set-up necessary to meet the objectives	4
CO5:-Develop a computational techniques to meet the objectives	4
CO6: -Apply the fundamental knowledge of thermal Engineering to real life problem	4

Description

Students are expected to choose real-world contemporary problem and apply the engineering principles learned, to solve the problem through building prototypes or simulations or writing codes or establishingprocesses/synthesis/correlations.

The dissertation shall be submitted as per the schedule given in the academic calendar. The dissertation supervisor will periodically review the progress of the student and finally give his/her assessment of the work done by the student.

M. Tech Dissertation Rubric Analysis:

Task	Description
I	Selection of Topic
II	Literature Survey
III	Defining the Objectives and Solution Methodology
IV	Performance of the Task

@The CO-PO Mapping Matrix								
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3
CO3	3	3	3	2	2	2	3	3
CO4	3	3	3	2	2	3	3	3
CO5	3	3	3	2	2	3	3	3
CO6	3	3	3	2	2	3	3	3

SEMESTER-IV

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

Second Year MTech Heat Power Engineering

24P1423: Internship

Teaching Scheme	Credit	Examination Scheme
TH: 04 Hours/Week	**04**	**CAT: 40 Marks** **CCE: 40 Marks** **End_Sem: 120 Marks** **Total: 200 Marks**

Prerequisite: Knowledge of Thermal Engineering, manufacturing processes, modeling, and mechanical systems.

Course Objectives:

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and understand real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To nurture professional and societal ethics.

To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes: On completion of the course, learner will be able to–	BL
CO1: Demonstrate professional competence through industry internship.	2
CO2: Apply knowledge gained through internships to complete academic activities in a professional manner.	3
CO3: Choose appropriate technology and tools to solve given problem	4
CO4: Demonstrate abilities of a responsible professional and use ethical practices in day to day life.	4
CO5: Create network and social circle, and developing relationships with industry people.	4
CO6: Analyze various career opportunities and decide carrier goals.	4

Guidelines

Every student has to undergo Internship. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales. Core objective is to expose technical students to the industrial environment. Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training

The internship maybe undergone in an Industry/Research organization/Govt. Organizations/NGO/ Innovation/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry.

Student can take internship work in the form of the following but not limited to:

- Working for consultancy/ research project,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Industry / Government Organization Internship,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,
- Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills
- Communication & Presentation Skills
- Team Work
- Creativity

- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work
- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Diary/Work book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines and other sources)

Feedback from internship supervisor(External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership…..

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	3	2	3	2	3	3
CO2	3	3	3	2	3	3	3	3
CO3	3	3	3	2	3	2	3	3
CO4	3	3	3	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3
CO6	3	3	3	2	3	3	3	3

Matoshri College of Engineering & Research Centre, Nashik **Master of Technology in Heat Power Engineering 2024-25** **First Year MTech Heat Power Engineering** **24P1424: MOOC-4**		
Teaching Scheme	**Credit**	**Examination Scheme**
TH: 02 Hours/Week	**02**	**CAT: 20 Marks** **CCE: 20 Marks** **End Sem: 60 Marks** **Total: 100 Marks**

NPTEL Courses under SWAYAM for AY 2025-26

MOOC-1: NPTEL Courses under SWAYAM for AY 2025-26#	
Course Code	**Course Name**
24P1423-A	**Note:** Course Names will be declared as per availability of NPTEL courses of 12/16 weeks available in that particular year for the semester
24P1423-B	
24P1423-C	
24P1423-D	

Matoshri College of Engineering & Research Centre, Nashik

Master of Technology in Heat Power Engineering 2024-25

First Year MTech Heat Power Engineering

24P1425

Skill Development in Thermal Systems/MOOC

Teaching Scheme	Credit	Examination Scheme
PR: 02 Hours/Week **TUT: 01 Hours/Week**	**02**	**CCE: 10 Marks** **CCE: 10 Marks** **End Sem: 30 Marks** **Total: 50 Marks**

Prerequisite: -

Course Objectives:

The objective of this course is to equip postgraduate students with advanced knowledge and practical skills in the field of thermal engineering. It aims to deepen their understanding of core concepts such as thermodynamics, heat transfer, and fluid mechanics, and their application in real-world engineering scenarios. The course emphasizes the development of hands-on expertise through laboratory experiments, simulation-based learning using modern tools like ANSYS Fluent and MATLAB, and project work that reflects industry practices

Course Outcomes: On completion of the course, learner will be able to–	BL
CO1: Apply advanced concepts of thermodynamics, heat transfer, and fluid mechanics to analyze and solve complex thermal engineering problems.	3, 4
CO2: Use modern simulation tools and software (such as ANSYS Fluent and MATLAB) to model, design, and evaluate thermal systems effectively.	3, 5
CO3: Conduct laboratory experiments, analyze data, and interpret results to assess the performance and efficiency of thermal systems.	4, 5
CO4: Perform energy audits and recommend optimization techniques for improving the performance of thermal equipment and processes.	5, 3
CO5: Demonstrate effective teamwork, communication skills, and ethical practices in engineering problem-solving and project execution	3
CO6: Develop and present technical reports or project documentation with clarity and professionalism, reflecting critical thinking and application of thermal engineering knowledge	6

Syllabus

Assignment/Case Study (any five)

1. Heat Exchanger Simulation Using Suitable Software

- Write a code to simulate a counterflow heat exchanger.
- Perform parametric analysis:
- Varying flow rates
- Inlet temperatures
- Different fluids
- Plot: Effectiveness vs. NTU, Temperature profiles

2. Building Heat Gain Simulation Using Software

- Model a simple building (2–3 rooms).
- Input building geometry, envelope data, weather file, occupancy schedules.
- Simulate and extract:
- Hourly cooling load profile
- Peak load time and value

3.**Energy Audit of thermal Power Plant/Simulation**

- Identify key loss areas in the plant:
  - Boiler flue gas losses
  - Turbine exhaust losses
  - Condenser losses
  - Auxiliary power consumption (fans, pumps, mills)
- Estimate these losses using formulas and data (or simulate them)

4.**Waste Heat recovery**

- Provide a brief **overview of waste heat recovery** and its importance in industrial applications, particularly in energy-intensive industries like cement, steel, and power plant
- Select any one industrial process that generates significant waste heat
  - Cement manufacturing (e.g., kiln exhaust)
  - Steel production (e.g., blast furnace exhaust)
  - Power plants (e.g., flue gas from coal or gas turbines)
  - Refineries (e.g., waste heat from distillation columns)
  - Glass manufacturing (e.g., molten glass cooling)

5.**Solar thermal System**

- Identify an Application for the Solar Thermal System: Choose one of the following types of systems for your case study:
- Residential Solar Water Heating System for a family home or apartment complex.
- Solar Process Heat for Industrial Application (e.g., food processing, chemical manufacturing, textile industries).

4. Students should provide context for the case study, including the industry or application area (e.g., power generation, HVAC systems, renewable energy, etc.).

- Solar Power Plant for electricity generation in an industrial area or a small community.
- Solar District Heating for a neighborhood or community

6. Industrial Refrigeration Systems

Choose an Industrial Application: Select one of the following industrial systems for case study:

- Food Storage Warehouse: Design a refrigeration system to maintain temperatures for a large warehouse that stores frozen or perishable goods.
- Cold Storage for Pharmaceuticals: Design a refrigeration system for a facility that needs precise temperature control for storing pharmaceutical products.
- Chemical Processing Plant: Design a refrigeration system that provides cooling for a chemical reactor or other process equipment.
- Ice Production Facility: Design a refrigeration system to produce and store ice for industrial use.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	3	2	3	2	3	3
CO2	3	3	3	2	3	3	3	3
CO3	3	3	3	2	3	2	3	3
CO4	3	3	3	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3
CO6	3	3	3	2	3	3	3	3

Teaching Scheme:	Credit	Examination Scheme:
PR: 16 Hours/Week	**08**	**CCE 1: 50 Marks** **CCE 2: 50 Marks** **End_Sem: 150 Marks** **Total: 250 Marks**

Prerequisite: Nil

Course Objectives:

1. To develop the setup/model based on the literature survey
2. To familiarize the students about the carrying out experimentation/ computer programming/ software
3. To understand the report writing, analysis of result, preparation of manuscript etc.

Course Outcomes: On completion of the course, learner will be able to–	**BL**
CO1: - Identify the materials and methods for carrying out experiments	2
CO2: - Execute the research methodology with a concern for society, environment and ethics	3
CO3: - Analyze, discuss and justify the results/trends and draw valid conclusions	4
CO4: - Prepare the report as per recommended format and present the work orally adhering to stipulated time	4
CO5: -Explore the possibility to publish/present a paper in peer reviewed journals/conference proceedings without plagiarism.	3
CO6:-Apply the knowledge to develop thermal Engineering Solution through experimentation and Modern tools and techniques.	4

Description

Students are expected to choose real-world contemporary problem and apply the engineering principles learned, to solve the problem through building prototypes or simulations or writing codes or establishingprocesses/synthesis/correlations.

The dissertation shall be submitted as per the schedule given in the academic calendar. The dissertation supervisor will periodically review the progress of the student and finally give his/her assessment of the work done by the student.

M. Tech Dissertation Rubric Analysis:

Task	Description
I	Selection of Topic
II	Literature Survey
III	Defining the Objectives and Solution Methodology
IV	Performance of the Task
V	Dissertation Preparation
VI	Review (Presentation & Understanding)
VII	Viva-Voce
VIII	Publications

Instructions for Dissertation Writing

It is important that the procedures listed below be carefully followed by all the students of M. Tech (Mechanical Heat Power Engineering).

1. Prepare Three Hard Bound Copies of your manuscript.

2. Limit your Dissertation report to 70 – 150 pages (preferably)
3. The footer must include the following:
   Institute Name, M.Tech Mechanical (Heat Power Engineering) Times New Roman 10 pt. andcentrally aligned.
4. Page number as second line of footer, Times New Roman 10 Pt, centrally aligned.
5. Print the manuscript using
   a. Letter quality computer printing.
   b. The main part of manuscript should be Times New Roman 12 pt. with alignment-justified.
   c. Use 1.5 line spacing.
   d. Entire report shall be of 5- 7 chapters.
6. Use the paper size 8.5'' × 11'' or A4 (210 × 197 mm.
7. All paragraphs will be 1.5 lines spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
8. Section titles should be bold with 14 pt typed in all capital letters and should be left aligned
9. Sub-Section headings should be aligning at the left with 12 pt, bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
   a. Illustrations should not be more than two per page. One could be ideal
   b. Figure No. and Title at bottom with 12 pt
   c. Legends below the title in 10 pt
   d. Leave proper margin in all sides
   e. Illustrations as far as possible should not be photo copied.
11. Photographs if any should of glossy prints
12. Please use SI system of units only.
13. Please number the pages on the front side, centrally below the footer
14. References should be either in order as they appear in the thesis or in alphabetical orderbylast name of first author
15. Symbols and notations if any should be included in nomenclature section only
16. Following will be the order of report
   i. Cover page and Front page as per the specimen on separate sheet
   ii. Certificate from the Institute as per the specimen on separate sheet
   iii Acknowledgements
   iv. List of Figures
   v. List of Tables
   vi. Nomenclature
   vii. Contents
   viii. Abstract (A brief abstract of the report not more than 150 words. The heading ofabstract i.e. word "Abstract" should be bold, Times New Roman, 12 pt and shouldbe typed at the centre. The contents of abstract should be typed on new line withoutspace between heading and contents. Try to include one or two sentences each onmotive, method, key-results and conclusions in Abstract

1 Introduction (2-3 pages) (TNR – 14 Bold)
1.1 Problem statement (TNR – 12)

1.2 Objectives
1.3 Scope
1.4 Methodology
1.5 Organization of Dissertation

@The CO-PO Mapping Matrix								
CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	3	3
CO2	3	3	3	2	3	2	3	3
CO3	3	3	3	2	2	2	3	3
CO4	3	3	3	2	2	2	3	3
CO5	3	3	3	2	2	2	3	3
CO6	3	3	3	2	2	2	3	3