

GANPAT UNIVERSITY										
FACULTY OF ENGINEERING & TECHNOLOGY										
Programme		Diploma Engineering				Branch		Mechanical Engineering		
Semester		IV				Version		1.0.0.0		
Effective from Academic Year			2019-20			Effective for the batch Admitted in			June 2018	
Subject code		1ME2402		Subject Name		Thermal Engineering-I				
Teaching scheme					Examination scheme (Marks)					
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total	
	L	TU	P	TW						
Credit	3	0	1	0	4	Theory	40	60	100	
Hours	3	0	2	0	5	Practical	30	20	50	

Pre-requisites:
Basic knowledge of Thermodynamics.

Course Learning Outcomes:
The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:
CO1. Determine steam properties and dryness fractions.
CO2. Classify and explain boilers, boiler mountings and accessories. Determine boiler performance
CO3. Explain working of steam prime movers, steam condensers and cooling towers.
CO4. Explain air compressors and observe the parameters affecting the performance

CO5. Calculate heat transfer for given heat transfer system.

Course Content				
Name of UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
UNIT – 1 Properties of steam	1.1 Two phase system-concept		10	8
	1.2 Formation of steam, its various phases, define wet steam, dry steam, saturated steam and superheated steam on PV, T-s and H-s diagram.	1a. Explain Steam formation process and terminology.		
	1.3 Concept and determination of dryness fraction and degree of superheat, latent heat, sensible heat, enthalpy, entropy and specific volume of steam	1b. Use steam table and Mollier chart for determination of steam property.		
	1.4 Use of Steam tables and Mollier chart- (Heat Entropy Chart).	1c. Determine dryness fraction of steam.		
	1.5 Numerical examples based on above			
	1.6 Throttling process. Methods of measurement of steam quality, Calorimeters-Bucket, Separating, Throttling and Combined calorimeters			

		1d. Explain throttling process.		
UNIT – 2 Steam Boilers, Boilers mountings and accessories	2.1 Steam boiler-concept, definition as per Indian Boilers Regulation (IBR), functions, features and classification 2.2 Working, Advantages and disadvantages of following low pressure steam boilers	2a. Classify Boilers	14	11
	<ul style="list-style-type: none"> ● Cochran boiler 	2b. Explain the working of boilers, mountings and accessories		
	<ul style="list-style-type: none"> ● Babcock and Wilcox water tube boiler 	2c. Explain boiler performance.		
	<ul style="list-style-type: none"> ● Lancashire boiler. 			
	<ul style="list-style-type: none"> ● Cornish boiler. 			
	<ul style="list-style-type: none"> ● Packaged boiler. 			

	<ul style="list-style-type: none"> Waste heat recovery boiler 			
	<p>2.3 Concept of fluidized bed combustion boiler.</p> <p>2.4 Boiler mountings and accessories-Location, functions, working on boilers</p> <p>2.5 Boiler draught system-concept and classification.</p>			
	<p>2.6 Boiler performance –affecting parameters, evaporative capacity, equivalent evaporation, Boiler efficiency, heat balance sheet, simple numerical examples based on these.</p>			
	<p>2.7 Maintenance, inspection and safety precautions in boiler house (As per IBR),</p>			
<p>UNIT – 3 Steam prime movers</p>	<p>3.1 Concept and classification of prime movers.</p>	<p>3a.Explain principle of working and construction of Steam turbine.</p>	8	6
	<p>3.2 Steam nozzles-types, working and applications. Mass and velocity of steam discharge through nozzle (No derivation). Simple numerical examples.</p> <p>3.3 Steam turbine- concept and classification. Impulse and reaction turbines working and differences</p>	<p>3b.Apply principle of steam nozzles to solve simple examples.</p> <p>3c.Describe compounding of</p>		

	<p>3.4 Compounding of steam turbine:</p> <ul style="list-style-type: none"> • Need. • Pressure compounding. • Velocity compounding. • Pressure velocity compounding. 	<p>steam turbine.</p>		
<p>UNIT – 4 Steam condensers and cooling towers</p>	<p>4.1 Condenser-Concept, Classification, function and working.</p> <p>4.2 Jet condensers and surface condensers- constructional sketch, working and</p>	<p>4a. Describe working of condensers.</p> <p>4b. Determine efficiency of condensers.</p> <p>4c. Describe working of cooling towers.</p>	<p>6</p>	<p>4</p>

	<p>differences</p> <hr/> <p>4.3 Vacuum efficiency and condenser efficiency- simple numerical example.</p> <hr/> <p>4.4 Cooling towers-Concept, Classification, function and working.</p> <hr/>			
<p>UNIT – 5 Air compressors</p>	<p>5.1 Air compressor-concepts, functions, classification and applications</p> <p>5.2 Working of reciprocating air compressor and rotary air compressors</p> <p>5.3 Single stage air compressor and multistage air compressor</p> <hr/> <ul style="list-style-type: none"> Working. <hr/> <ul style="list-style-type: none"> Inter-cooling & after cooling <hr/> <p>5.4 Power required and efficiency of reciprocating air compressors-single and two stages, simple numerical</p>	<hr/> <p>5a. Describe principle, construction and Working of air compressors.</p> <hr/> <p>5b. Calculate power requirement and volumetric efficiency of reciprocating air compressor.</p> <hr/>	11	8

	examples.			
	5.5 screw compressors- Concept			

<p>UNIT – 6 Heat transfer</p>	<p>6.1 Various modes of heat transfer</p>		<p>11</p>	<p>8</p>
	<p>6.2 heat transfer by Conduction - Fourier's law, thermal conductivity, heat transfer through a plain wall, composite wall and cylinder.</p>	<p>6a. Explain modes of heat transfer</p>		
	<p>6.3 heat transfer by Convection- Newton's law of convection, difference between Free and force convection.</p>	<p>6b. Determination of heat transfer through cylinder and wall.</p>		
	<p>6.4 heat transfer by Radiation- Stefan and Boltzmann's law,</p>			
	<p>emissivity, absorptivity, reflectivity, transmissivity, concept of Blackbody</p>			
	<p>6.5 Need, types, properties and applications of insulating materials in various industries</p>			
<p>6.6 Over all heat transfer coefficient. Simple numerical</p>				

examples based on above.

6.7 Heat exchanger- introduction, types and applications- Logarithmic Mean Temperature Difference (LMTD) concept

6c. Explain types of insulations

1	I	<p>Preparatory Activity:</p> <p>Based on Given the data, determine properties of steam using steam table and Mollier chart.</p>
2	II	<p>To Demonstrate Steam Boilers, Boiler Mountings and accessories.</p>
3	II	<p>To determine boiler efficiency, equivalent evaporation and Heat balance sheet</p>
4	III	<p>To Demonstrate impulse and reaction turbines.</p>
5	IV	<p>To Demonstrate Steam condensers Cooling towers.</p>
6	V	<p>Performance test on a reciprocating air compressor and determine its volumetric efficiency</p>
7	VI	<p>Determine overall heat transfer coefficient and LMTD of heat exchanger.</p>
8	ALL	<p>Mini Project And Presentation:</p> <p>i. Identify any one thermal equipment/device/plant (which are included in syllabus) at nearby industry. Sketch the setup, write its specifications, and explain the working of that with process parameters and state applications of that.</p> <p>ii. Prepare a chart or model on given topic. Prepare the seminar.</p>

List of Instruments / Equipment / Trainer Board	
1	Cut section/ models of boilers, boiler mountings and accessories.
2	Cut section/ models of steam prime movers.
3	Test rigs of condensers and cooling towers.

4	Test rig of reciprocating air compressor.
5	Experimental setup of heat exchanger.
6	Independently temperature and pressure measuring instruments

List of Reference Books			
No	Title of Reference Books	Authors	Publication
1	Thermal Engineering	P.L.Ballaney	Khanna.Publishers
2	Thermal Engineering	A. S. Sarao	SatyaPrakashan
3	Thermal Engineering	R.K.Rajput	Laxmi Publication
3	Heat Engines	Pandya and Shah	CharotarPublishing House
4	Thermal Engineering	B K Sarkar	Tata McGraw Hill

Link of Learning Web Resource	
1	http://nptel.iitm.ac.in/courses/112101097/
2	http://nptel.iitm.ac.in/courses/112106155/
3	http://nptel.iitm.ac.in/courses/112101002/
4	http://www.thermaxindia.com/Large-Industrial-Boilers/Waste-HeatRecovery-Boiler.aspx
5	http://www.bhel.com/product_services/range.php?rangeid=146&productid=106&categoryid=141

CO'S AND PO'S MAPPING

PO'S/CO'S	CO1	CO2	CO3	CO4	CO5

PO1	Proficiently applies concepts, theories and techniques of the relevant natural, physical sciences and knowledge in mathematics.	SUB	SUB	SUB	SUB	SUB
PO2	Use basic principles of statics, dynamics, fluid mechanics, engineering materials, strength of materials engineering standards and manufacturing processes to aid in the design, characterization, analysis and troubleshooting of mechanical system.	SUB	SUB	SUB	SUB	SUB
PO3	Apply their engineering knowledge, critical thinking and problem solving skills in professional engineering practice or in non-engineering fields, such as law, medicine or business.	SUB	SUB	SUB	SUB	SUB
PO4	Continue their intellectual development, through, for example, graduate education or professional development courses	MED.	SUB	SUB	SUB	SUB
PO5	Use of appropriate computer languages, modern tool and application software that pertain to Mechanical engineering technology systems.	SLI	MED.	MED.	MED.	MED.
PO6	Ability to identify problems, conducts experiments, gather data, analyze data and produce results.	SUB	MED.	MED.	MED.	SUB
PO7	Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges of the 21st century	NONE	MED.	MED.	NONE	NONE
PO8	Design a system component or process to meet desired need within realistic constraints, such as economic, environmental and social.	MED.	MED.	MED.	MED.	MED.
PO9	Values the need for, and demonstrates, ethical conduct and professional accountability.	NONE	NONE	NONE	NONE	NONE
PO10	Demonstrates effective communication to professional and wider audiences.	SLI	SUB	SUB	SUB	SLI
PO11	Appreciates entrepreneurial approaches to engineering practice.	NONE	SUB	SUB	SUB	NONE
PO12	Apply commitment to quality, timeliness, and continuous improvement.	SLI	SLI	SLI	SLI	SLI