



## **C.U.SHAH UNIVERSITY – Wadhwan City**

**FACULTY OF:** - Technology and Engineering (Diploma Engineering)

**DEPARTMENT OF:** - Mechanical Engineering

**SEMESTER:** - IV                      **CODE:** - 2TE04THE1

**NAME OF SUBJECT:** - Thermal Engineering-I

### **Teaching & Evaluation Scheme:-**

Subject Code	Name of the Subject	Teaching Scheme				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hours	Marks	Hours	Pr/ Viva	TW	Pr	
<u>2TE04THE1</u>	Thermal Engineering-I	03	00	02	05	4	30	1.5	70	03	30	20	----	150

### **Objective: -**

- Well trained mechanical engineer should have a thorough grading in the basic knowledge of thermal engineering.
- The object of this course is to establish basic fundamental practical knowledge in the field of thermal engineering which includes boiler operations, boiler mountings and accessories, heat transfer, condensers, air compressor, two phase system etc.
- The course will provide a mature approach to the basic principles of thermal engineering which will function as foundation in applications in major fields of mechanical engineering and technology notably in steam and nuclear power plants, compressors etc....

**Prerequisites:** - Thermodynamics

### **Course outline:-**

Sr. No.	Course Contents	Number of Hours
1	<b>Two Phase System.</b> Concept of two phase system, Formation of steam, its various phases, definition and representation of wet steam, dry steam, saturated steam and superheated steam on PV, T-s and H-s diagram, Concept, definition and determination of dryness fraction and degree of superheat, Concept, definition and determination of latent heat, sensible heat, enthalpy, entropy and specific volume of steam, Use of Steam tables and Mollier chart- (Heat Entropy Chart), Numerical examples based on above, Throttling process, Methods of measurement of steam quality, Calorimeters- Bucket, Separating, Throttling and Combined calorimeters. (No numerical Problems).	07
2	<b>Boilers, Mountings and Accessories.</b> Steam boiler-concept, definition as per Indian Boilers Regulation (IBR), functions, features and classification, Working, merits and demerits of following low pressure steam boilers: ( Simple vertical boiler, Lancashire boiler, Cornish boiler, Cochran boiler, Babcock and Wilcox water tube boiler ), Boiler mountings and accessories- functions, working and location on boilers, Boiler draught system-concept and classification, Boiler performance – parameters, evaporative capacity, equivalent evaporation, efficiency, heat balance sheet, simple numerical examples based on these, Maintenance, inspection and safety precautions in boiler house (As per IBR), check list in boilers.	09
3	<b>Steam Prime Movers.</b> Concept and classification of prime movers, Steam nozzles-types, working and applications. Mass and velocity of steam discharge through nozzle (No derivation), Steam turbine – concept and classification. Impulse and reaction turbines (constructional and	06

	materials details.)-working and differences, Compounding of steam turbine: ( Need, Pressure compounding, Velocity compounding, Velocity compounding, Pressure velocity compounding )	
4	<b>Steam Condensers and Cooling Towers.</b> Concept, function and classification of condensers, Jet condensers and surface condensers- constructional sketch, working and differences, Vacuum efficiency and condenser efficiency of condensers- simple numerical example, Classification, function and working of cooling towers.	05
5	<b>Air Compressors.</b> Air compressor-concepts, functions, classification and applications, Working of reciprocating air compressor and rotary air compressors, Single stage air compressor and multistage air compressor (Working, Inter-cooling & after cooling ), Power required and efficiency of reciprocating air compressors-single and two stages, simple numerical examples.	09
6	<b>Heat Transfer.</b> Various modes of heat transfer, Conduction heat transfer- Fourier's law- explanation (No Cartesian or other equation derivation), thermal conductivity, heat transfer through a plain wall, composite wall and cylinder, Convection heat transfer, Newton's law of convection, Free and forced convection, coefficient of convection, Radiation heat transfer, Blackbody concept, emissivity, refractivity, absorptivity, Stefan and Boltzmann's law, Need, types, properties and applications of insulating materials in various industries, Overall heat transfer coefficient , Simple numerical examples based on above, Heat exchanger: introduction, types and applications- Logarithmic Mean Temperature Difference (LMTD) concept- (No derivation & no numerical examples).	06

#### List of Experiments:-

- To study about thermodynamic properties.
- To study about thermodynamic SI units and their conversions.
- Explain thermodynamic processes
- To study about Mollier chart
- Demonstration of Low pressure boilers.
- Demonstration of Boiler mountings and accessories.
- To determination of boiler efficiency, equivalent evaporation and Heat balance sheet.
- To Demonstrate Steam prime movers-impulse and reaction turbines.
- To Demonstrate Steam condensers & Cooling towers.
- Performance test on a reciprocating air compressor and determine its volumetric efficiency.
- Mini Project and Presentation

#### Suggested List of Student Activities:-

- Prepare Mollier charts and show different regions.
- Collect/ download product catalogues with specification of various types of energy conservation equipment/ devices and heat exchanger of recent trends.
- At least one visit of any power plant/ industry where various items like boiler, air compressor, heat exchanger, cooling tower, condenser etc. can be shown to students.
- Identify and list at least 10 equipments/devices which require heat transfer and prevention of heat transfer. Also state mode of heat transfer and methods used to prevent heat transfer.

#### Books Recommended:-

- Heat Engines, Pandya and Shah, Charotar Publishing House
- Thermodynamics and Heat power Engg, Mathur and Mehta, Tata Mcgraw- Hill
- Heat and mass transfer, D S Kumar, S K Kataria&Sons
- Thermal Engineering, P.L.Ballaney, Khanna. Publishers
- Thermal Engineering, A. S. Sarao, SatyaPrakashan
- Heat and mass transfer, R K Rajput, S. Chand
- Practical Thermodynamics, G D Rai, Khanna Publisher
- A Text book of Thermal Engineering, R S Khurmi& J K Gupta, S Chand & Co