GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering
Level: PG
Subject Code: ME02000771
Subject Name: Process Plant Utility and Piping Design

w.e.f. Academic Year:	2024-25
Semester:	3
Category of the Course:	MOPEC

Prerequisite:	Basics of Fluid Flow Operations, Heat Transfer Operations and Mass Transfer Operations
Rationale:	Utilities play a key supporting role in operating most of the process units in chemical process industries. The course is designed to provide postgraduate students with a comprehensive understanding of the essential components involved in the design of piping system, and operation of utility systems.

Teaching and Examination Scheme:

			Total Credits L+T+(PR/2)	**Assessment Pattern and Marks**				**Total Marks**
L	**T**	**PR**	**C**	**Theory**		**Tutorial/Practical**		
				ESE (E)	PA/CA (M)	ESE(V)	PA/CA(I)	
3	0	0	3	70	30	00	20	100

Course Content:

Unit No.	Content	No.of Hours	%of Weightage
1.	Introduction: Utilities in process industries; primary and secondary utilities, and their importance.	2	4
2.	Boilers: Boiler types and classifications, Performance evaluation of boilers (Direct and Indirect method), Boiler water treatment, Blow down, Thermic fluid heaters, Energy saving opportunities in boilers.	7	16
3	Steam System: Properties of steam, Steam distribution system, Steam traps (Thermostatic, Mechanical, and Thermodynamic), Assessment of steam traps, Energy saving opportunities in steam system.	6	13

4.	Piping System: Classification of pipe, Codes and standards, Pipe Fabrication, vibration, its prevention and control in piping systems, Mechanical Properties of material, schedule number, Piping materials and selection, Determination of pipe size, Calculation of pressure drop in pipe, Equivalent length of pipe line for fittings and valves, Energy losses in pipe line, Process design of piping system, Mechanical design of pipes.	9	20
5	Pumps: Different types of pumps and their selection criteria, NPSHA & NPSHR, Power required by pump, Pump curves, Pump sizing, Factors affecting pump's performance, Flow control strategies, Energy saving opportunities in pumping system.	8	18
6	Compressed Air System: Classification of compressors, Compressor performance assessment, Components of compressed air system, Measures in compressed air system for its efficient operation.	4	9
7	Cooling Tower: Psychrometric chart, Types of cooling towers, Components of cooling tower, Performance of cooling tower, Factors affecting the performance of cooling tower, Measures for efficient cooling tower operation.	5	11
8	Refrigeration System: Types of refrigeration systems, Performance assessment of refrigeration plants, Factors affecting the performance of refrigeration plants.	4	9
	Total	**45**	**100**

Course outcomes:

After Completion of the Course, Student will able to:

No	Course Outcomes	Level
01	Understand the importance of process utilities and piping system in a chemical industry.	U
02	Evaluate the performance of given process utility.	E
03	Diagnose problems in utility and piping systems.	A
04	Design the given utility of chemical process industries to comply with codes and standards.	C

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
7	14	28	7	7	7

Where R:Remember;U:Understanding;A:Application,N:Analyze and E:Evaluate C:Create (as per Revised Bloom's Taxonomy)

References/ Suggested Learning Resources:

Books:

1. Plant Utilities by D.B. Dhone, Nirali Prakashan Publication.
2. Thermal Engineering by P.L.Balleney, Khanna Publisher, New Delhi.
3. Energy Efficiency in Thermal Utilities, Guide Book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency, New Delhi, India.
4. Energy Efficiency in Electrical Utilities, Guide Book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency, New Delhi, India.
5. Introduction to Process Engineering and Design by S.B. Thakore and B.I. Bhatt, Tata McGraw Hill Education Private Limited.

Presentation based on above topics.

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