

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (30) PROCESS AUXILIARIES AND UTILITIES SUBJECT CODE: 2723013 SEMESTER: II

Type of course: Chemical Engineering (MAJOR ELECTIVE III)

Prerequisite: The student should have basic understanding of Chemical Engineering Economics and Plant design.

Rationale: Process auxiliaries and utilities involve the understanding of designing the process plants or creating design layouts of plant. It also involves the fundamentals of chemical engineering viz. development of flow diagrams, importance of various design consideration during the development and design of any process. With rapid rate of increase in the advancement of knowledge, it is important that the students should know the relevant importance and application of various process auxiliaries and utilities used in industries. This subject deals with the basics as well as advanced understanding of various process auxiliaries and utilities used in chemical plant.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	<p>Process Auxiliaries: Basic considerations and flow diagrams in chemical engineering plant design.</p> <ul style="list-style-type: none"> Piping design: Selection of material, pipe sizes, working pressure, Basic principles of piping design, piping drawings, pipe installations, overhead installations, Process steam piping, selection and determination of steam – pipe size, Piping insulation, application of piping insulation, weather proof and fire resisting pipe insulation jackets, piping fittings, pipe joints. Valves: Types of valves, selection criteria of valves for various systems. Pumps: Types of pumps, NPSH requirement, pump location, pump piping, pump piping support. Process control and instrumentation diagram, control system design for process auxiliaries. 	27	50%
2	<p>Process Utilities:</p> <ul style="list-style-type: none"> Process Water: Sources of water, hard and soft water, Requisites of industrial water and its uses, Methods of water treatment, Chemical softening, Demineralization, Resins used for water softening, Water for boiler use, cooling purposes, cooling towers, drinking and process water treatment, reuse and conservation of water, 	27	50%

	<p>water resources management, waste water treatment and disposal.</p> <ul style="list-style-type: none"> • Steam: Steam generation and its application in chemical process plants, distribution and utilization, boilers, design of efficient steam heating systems, steam economy, condensate utilization, steam traps, their characteristics, selection and application, waste heat utilization. • Compressors and Vacuum Pumps: Types of compressors and vacuum pumps and their performance characteristics, Methods of vacuum development and their limitations, materials handling under vacuum, lubrication and oil removal in compressors and pumps, instrument air. • Refrigeration and Chilling systems. • Oil heating systems, Nitrogen systems. 		
--	---	--	--

Reference Books:

1. M.S. Peters and Timmerhaus, "Plant design and Economics for Chemical Engineers", Mc Graw Hill 3rd Edition.
2. F.C. Vibrandt and C.E. Dryden, "Chemical Engineering Plant Design", McGraw Hill, Fifth Edition.
3. Roger Hunt and Ed Bausbacher, "Process Plant layout and Piping Design" PTR Prentice-Hall Inc.,
4. Jack Broughton; Process utility systems; Institution of Chem. Engineers, U.K.

Course Outcome:

After learning the course the students should be able to:

1. Learn about the overall knowledge about the process plant.
2. Understand the importance of process auxiliaries and utilities in process industries.
3. Learn the conceptual design of chemical process plant.
4. Build a bridge between theoretical and practical concepts used for process auxiliaries and utilities in any process industry.

List of Open Source Software/learning website:

- 1) Literature available for Process auxiliaries and utilities in chemical plant / industry.
- 2) NPTEL Video Lectures.
- 3) MIT Open course lecture on Process auxiliaries and utilities.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website