

Course Name : Chemical Engineering

Course Code : CH

Semester : Forth

Subject Name : Plant Utilities

Subject Code : 9202

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
02	--	02	03	80	20	--	--	25@	125

Rationale:

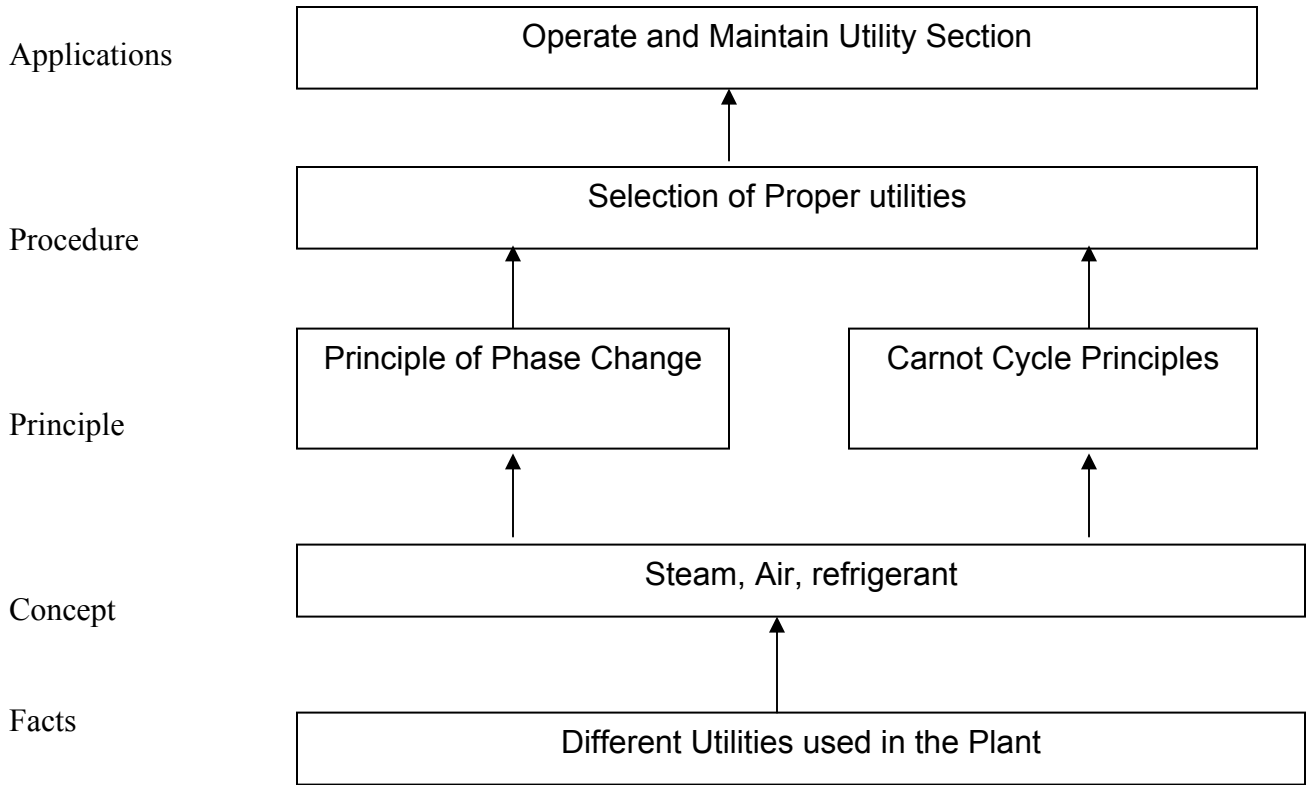
This subject covers the requirement of different utilities for the process plant, along with its generation and its effective utilization. Main utilities required for process plants are water, steam, air & refrigerants. Steam & non-steam heating media are important for conversion of raw material to products in reactors & to elevate the temperature in the chemical processes. Refrigeration is important to maintain the temperature in the process plant. Compressed air, process air is used in processes & instrument air is used in pneumatic devices & controls.

Objective:

The subject the student will be able to:

1. State the principles involved during water treatment, generation of steam and its uses, refrigeration cycles.
2. Describe the different equipments used to run the process plant with different utilities.
3. Acquire the knowledge for selection of different utilities.
4. Understand basic calculation involved in steam generation, psychometric operation and refrigeration.

Learning Structure:-



Contents : Theory

Chapter	Name of the Topic	Hours	Marks	
1.	Importance of utilities :			
	1.1 Sources of water, hard and soft water	2		
	1.2 Requisites of industrial water and its uses			
	1.3 Methods of water treatment			
	1.3.1 Chemical softening			
	1.3.2 Demineralization SS			
	1.4 Resins used for water softening	8	06	12
	1.5 Reverse osmosis and membrane separation			
2.	Refrigeration :			
	2.1 Refrigeration cycles	04		
	2.2 Different methods of refrigeration used in industry			
	2.2.1 Vapour compression	10		
	2.2.2 Vapour absorption: Lithium bromide (eco-Friendly)		07	18
	2.3 Different refrigerants			
	2.3.1 Monochlorodifluoro methane (R-22)			
	2.3.2 Chlorofluorocarbons (CFC-Free)	02		
2.3.3 Secondary refrigerants: Brines				
2.4 Simple calculation of C.O.P. Refrigerating effects.	02			
3.	Steam and steam generation :			
	3.1 Properties of steam			
	3.2 Problems based on enthalpy calculation for wet steam, dry saturated steam, superheated steam	10		
	3.3 Types of steam generator / boilers: water tube & fire tube			
	3.3.1 Solid fuel fired boiler.	10	10	24
	3.3.2 waste gas fired boiler.			
	3.3.3 Waste heat boiler.			
3.3.4 Fluidized bed boiler.				
3.4 Scaling, trouble shooting, preparing boiler for inspection				

	3.5 Steam traps, boiler mountings and accessories 4 3.6 Boiler Act		
4.	Psychrometry : 4.1 Properties of Air-water vapours. 4.2 Use of humidity chart 6 4.3 Equipment used for humidification, dehumidification Evaporative cooling, spray ponds, cooling towers 10	06	16
5.	Air : 5.1 Use of Compressed air, process air and instrument air 5.2 Process of getting instrument air.	02	06
6.	Non steam heating system Thermic fluid heater, Downtherm heater 6.1 Temperature range 6.2 Principle, construction & working.	01	04
TOTAL		32	80

Practical :

Skills to be developed:

- Intellectual skills :
- 1 Analysis of water.
 - 2 Calculation of humidity & use of humidity chart.
 - 3 Calculation heat load in cooling tower.

- Motor skills :
- 1 Observation of pH
 - 2 Handling of thermopack or boiler
 - 3 Handling of cooling tower.

Lists of Practials:

1. To determine the alkalinity of water
2. To determine the hardness of water .
3. To determine the variation in PH with ion exchange bed.
4. Determination of humidity and use of humidity chart
5. Boiler simulator.
6. Determination of outgoing temperature of water from any cooling tower.
7. Observing starting procedure of thermopack or boiler.
8. Draw & prepare the report of steam traps.

9. Observation of use of instrument air in pneumatic control valve.

Learning Resources:

Books:

Sr. No.	Author	Title	Publishers
1.	P. L. Balleney	Thermal Engineering	Khanna Publisher New Delhi
2.	S.T. Powel	Industrial water treatment	McGraw Hill, Newyork
3.	Chattopadhyya	Boiler operations	Tata McGraw Hill, New Delhi
4.	Perry R.H. Green D.W.	Perry's chemical Engineer's Handbook	McGraw Hill, Newyork
5.	R.C. Patel C.J. Karmchandani	Elements of Heat Engines Vol – II,III	Acharya Book Depot. Vadodara
6	P .N .Ananthanarayan	Refrigeration & Air conditioning	Tata McGraw Hill
7	JAIN & JAIN	Industrial chemistry	-