

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN CHEMICAL ENGINEERING
SEMESTER: V

Subject Name: **Utilities and Instrumentation in Chemical Plant**

Sr. No.	Course Content
1.	Introduction of Utilities and Water as Basic Utility: 1.1 Brief Idea of various utilities: their role in chemical plant. 1.2 Sources of water. 1.3 Hard & Soft water. 1.4 Methods of softening of water: (a) Lime soda process (Hot & Cold) (b) Zeolite process (c) Ion exchange process (d) Phosphate process 1.5 Purification of water (a) Screening (b) Sedimentation (c) Coagulation (d) Filtration (e) Sterilization 1.6 Compare Boiler Feed water and demineralized water.
2.	Steam: 2.1 Introduction 2.2 Definition of (a) Enthalpy (b) Wet steam (c) Superheated steam (d) Specific volume (e) Saturated Steam 2.3 Steam Generator (with various components). 2.4 Classification & comparison of steam generators. 2.5 Factors affecting selection of Boiler. 2.6 Construction of various type of Boilers. (a) Locomotive Fire tube boiler (b) Lancashire boiler
3.	Air/inert Gas: 3.1 Introduction 3.2 Compressed Air 3.3 Blower Air 3.4 Fan Air 3.5 Application of Air 3.6 Types of Air compressors (a) Reciprocating Air compressors (b) Multistage compressors

	(c) Rotary compressors 3.7 Instrumental air 3.8 Inert gas like Nitrogen, Argon etc.
4.	Refrigeration: 4.1 Introduction 4.2 Various method of Refrigeration (a) Ice Refrigeration (b) Evaporative Refrigeration (c) Vapor Refrigeration System 4.3 Unit of Refrigeration & Definition of TOR 4.4 Different types of Primary Refrigerants with Physical properties of following (a) Ammonia (b) Halo Carbons (Freon of Different type) (c) HFC (Hydro Fluorocarbon) 4.5 Different types of secondary Refrigerants (a) Water (b) Brine 4.6 Selection of Refrigerants
5.	Introduction to Instrumentation: 5.1 Concept and importance of instrumentation 5.2 Classification of instruments 5.3 Basic elements of instruments 5.4 Characteristics of instruments in detail (Dynamic and Static) 5.5 First order system and second order system(Upto understanding level only)
6.	Temperature Measuring Devices: 6.1 Definition of thermometer 6.2 Temperature scale 6.3 Mercury in glass thermometer: Principle, Construction & Working 6.4 Bi-metallic and pressure spring thermometers: Principle, Construction & Working 6.5 Principles of thermoelectricity 6.6 See-back effect, Peltier effect and Thomson effect 6.7 Industrial thermocouple: their principle, construction, working range, lead wires. 6.8 Thermowells, in details 6.9 Construction and working of resistance thermometer 6.10 Simple Wheastone bridge circuit and Null bridge resistance thermometer. 6.11 Radiation and optical Pyrometers
7.	Pressure Measurement & Flow Measurement: 7.1 Explain: Pressure gauges like diaphragm, Bourdon tube gauge, Dead weight pressure, Gauge, Strain gauge. 7.2 Explain: Magnetic-Ultrasonic meter, Coriolis meter, Target meter, Vortex Shredding meter, Turbine meter.

8.	Viscosity Measurement: 8.1 Capillary tube method 8.2 Rotating cylinder method 8.3 Falling sphere method 8.4 Torsion viscometer
9.	Level Measurement: 9.1 Classify: Liquid level measuring devices 9.1.1 Direct level measuring devices (a) Probe and tape (b) Sight glass (c) Floats 9.1.2 Indirect level measuring devices. (a) Air trap box method (b) Diaphragm box method (c) Bellow system (d) Differential pressure manometer
10.	Control Valves, Simple Control Loops & Control System: 10.1 Function of relays and interlocks 10.2 Temperature control 10.3 Pressure control 10.4 Important control modes with simple diagram 10.5 Brief Idea of PLC and DCS system
11.	Miscellaneous: 11.1 Working and construction of Hair hygrometer 11.2 Working and construction of Hydrometer. 11.3 Working and construction of pH measurement

Laboratory Experiences:

1. Study of water treatment plant (Industrial visit) 8 hrs.
2. Study of Boilers (Industrial visit of a plant consisting boiler) 8 hrs.
3. Study of primary and secondary refrigeration in chemical plant 8 hrs.
4. Temperature measurement: bi-metallic thermometer 2 hrs.
5. Demonstration of thermo-couple 2 hrs.
6. Study of mechanical pressure gauges 2 hrs.
7. Demonstration of Bourdon tube 2 hrs.
8. Measurement of gas flow 2 hrs.
9. Viscosity measurement by capillary tube method 2 hrs.
10. Direct level measurement 2 hrs.
11. Study of control valves & actuators 2 hrs.
12. Study of DCS system (Industrial visit in a plant consisting DCS system) 8 hrs.
13. Measurement of humidity by Hair hygrometer 2 hrs.
14. Measurement of density by Hydrometer 2 hrs.
15. PH measurement by pH meter 2 hrs.
16. Measurement of concentration by conductivity 2 hrs.

Reference Books:

1. Industrial instrumentation, Donald P. Eckman.
2. Instrumentation, Kirk and Rimboi.
3. Instrumentation, Nirali Prakashan.
4. Unit operation of chemical Engineering McCabe & Smith.
5. Plant utilities, Nirali Prakashan.
6. Process control Koppel, Coughnour.
7. Process Instrumentation and Control, A. P. Kulkarni, Nirali Prakashan.