

INSTITUTE	DIPLOMA STUDIES
PROGRAM	DIPLOMA ENGINEERING (CHEMICAL ENGINEERING)
SEMESTER	4
COURSE TITLE	PLANT UTILIZATION AND INSTRUMENTATION
COURSE CODE	09CH2403
COURSE CREDITS	4

Objective:

- 1 To learn to Operate different utility plants and various types of instruments.

Course Outcomes: After completion of this course, student will be able to:

- 1 Use various methods for water softening and purification
- 2 Operate different types of steam generators
- 3 Operate compressors, blowers for handling air and inert gases.
- 4 Use Refrigeration for Various applications.
- 5 Measure temperature, pressure, flow, level and viscosity.
- 6 Operate various control valves and control systems

Pre-requisite of course: Std. X Chemistry, physics, Mathematics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
2	0	4	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Basic Utility List and use of various utilities in chemical plant, Sources of water, Types of Water, Hard & Soft water, Boiler Feed water and demineralized water. Methods of water softening processes (i) Lime soda process (Hot & Cold), (ii) Zeolite process, (iii) Ion exchange (iv) Filtration (v) Sterilization	4
2	Steam, Air & Inert Gases Utilities: Use of Steam, Air & Inert Gases as utilities, Types of Air compressors Reciprocating Air compressors (i) Multistage compressors (ii) Rotary compressors	4

Contents : Unit	Topics	Contact Hours
3	Refrigeration Concept of refrigeration, Methods of Refrigeration: (i) Ice Refrigeration, (ii) Evaporative Refrigeration, (iii) Vapor Refrigeration System. COP and TOR of refrigeration. Types of Primary Refrigerants: Ammonia, Halo Carbons (Freon of Different type), HFC (Hydro Fluorocarbon). Types of secondary Refrigerants: Water, Brine. Selection of Refrigerants.	4
4	Basics of Instrumentation Importance of instrumentation in chemical plant. Classification of instruments, Basic elements of instruments, Static and Dynamic Characteristics of instruments, First order system and second order system .	2
5	Measuring Devices Different Temperature scale, Principle, Construction & Working of: Mercury in glass thermometer, Bi-metallic thermometer, pressure spring thermometer, resistance thermometer, Principles of thermoelectricity: See-back effect, Peltier effect and Thomson effect. Pressure gauges: diaphragm, Bourdon tube gauge, Dead weight Gauge, Strain gauge. Classify: Liquid level measuring devices; Direct level measuring devices : Probe and tape, Sight glass, Floats; Indirect level measuring devices: Air trap box method, Diaphragm box method, Bellow system, Differential pressure manometer; Viscosity measurement: Capillary tube method, Rotating cylinder method, Torsion viscometer; measurement of Specific gravity by hydrometer, Humidity by hygrometer, pH by pH meter.	8
6	Control Valves, Control Loops & Control System Function of relays and interlocks, Control loops: Temperature control, Pressure control, Flow control, Level control. Process control modes : P , P+I , P+I+D, ON –OFF; uses of PLC and DCS System uses of PLC and DCS System	6
Total Hours		28

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment 1 Operate and test the working of air compressor	4
2	Experiment 2 Demonstrate different refrigeration cycles	4
3	Experiment 3 Treatment by lime soda process	4
4	Experiment 4 Study about Temperature Pyrometer	4
5	Experiment 5 Measure Temperature by thermometer and thermocouple	4

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	Experiment 6 Measure Temperature by Bi-metallic thermometer	4
7	Experiment 7 Study about Bourdon tube gauge	4
8	Experiment 8 Measure viscosity by capillary tube method	4
9	Experiment 9 Measure specific gravity by Hydrometer	4
10	Experiment 10 Measure humidity by Hair hygrometer	4
11	Experiment 11 Measure pH by pH meter	4
12	Experiment 12 Prepare a chart of components of DCS system	4
13	Experiment 13 Demonstrate working of control valves and actuators using chart	4
14	Experiment 14 Study about Rotary Compressor	4
Total Hours		56

Textbook :

- 1 Industrial instrumentation, Donald P. Eckman, John Wiley and Sons publications, 2004

References:

- 1 Industrial Instrumentation & Control , Industrial Instrumentation & Control , S. K. Singh 3rd edition , Tata-McGrawHil publications, 1987
- 2 Process Instrumentation and Control , Process Instrumentation and Control , A P Kulkarni , Nirali Prakashan, 2011
- 3 Unit operation of chemical Engineering, Unit operation of chemical Engineering, McCabe, Warren L., Julian C. Smith, McGraw Hill Publication, 2004
- 4 Plant utilities, Plant utilities, D. B. Dhone, Nirali Prakashan, 2012
- 5 Process System Analysis & Control, Process System Analysis & Control, Donald R. Coughnour, McGraw Hill Publication, 1991

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking
40.00	40.00	10.00	10.00	0.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc21_ch52/preview