



Department of Chemical Engineering		LP: CH18604
B.E/B.Tech/M.E/M.Tech : B.Tech	Regulation: 2018A	Rev. No: 00
PG Specialisation : NA		Date: 27/12/2023
Sub. Code / Sub. Name : CH18604/ Process Equipment Design I		
Unit : I		

Unit Syllabus: Sources of information on manufacturing processes, General sources of physical properties, Accuracy required of engineering data, Prediction of physical properties. Flow of fluids: Properties and units, pipeline networks, optimum pipe diameter, non-newtonian liquids.

Objective: To impart the knowledge on retrieve the chemical engineering basic design of process Equipments

Session No *	Topics to be covered	Ref	Teaching Aids
1	Sources of information on manufacturing processes	T1: Ch 8; P. no. 271 T2 : Ch 1; P.no: 2-6	PPT/ BB.
2	General sources of physical properties	T1: Ch 8; P. no. 272 T2: Ch 1; P.no: 2-6	PPT/ BB.
3	Accuracy required of Engineering data	T1: Ch 8; P. no. 273	PPT/ BB.
4	Prediction of physical properties	T1: Ch 8; P. no. 274	PPT/ BB.
5	Flow of fluids: Properties and units	T2: Ch 1; Pno. 83-84	PPT/ BB.
6	Pipeline networks	T2: Ch 6; P no. 90-92	PPT/ BB.
7	Optimum pipe diameter	T2: Ch 6; P no. 92-94	PPT/ BB.
8	Non- newtonian liquids.	T2: Ch 6; P no. 94-100	PPT/ BB.

Content beyond syllabus covered (if any):- Video lecture in pipeline layout

* Session duration: 50 minutes



Sub. Code / Sub. Name: CH18604/ Process Equipment Design I

Unit : II

Unit Syllabus: Separation Columns: Continuous Distillation: Basic Principles, Design Variables In Distillation, Design Methods For Binary Systems, Concepts of multicomponent distillation. Packed columns: Types of packing, Packed-bed height, Prediction of the height of a transfer unit (HTU), Column diameter (capacity), Column internals, Wetting rates. Solvent extraction: Type of extraction, Liquid-liquid extraction, Extraction equipment Extractor design, Extraction columns.

Objective: To understand the design features in distillation and extraction columns

Session No *	Topics to be covered	Ref	Teaching Aids
36	Continuous distillation: Basic principles	T1: Ch 2; P no 448-452	PPT/ BB.
37	Design variables in distillation	T1: Ch 2; P no 453-455.	PPT/ BB.
38	Design methods for binary systems	T1: Ch 2; P no 456-466.	PPT/ BB.
39	Concepts of multicomponent distillation	T1: Ch 2; P no 470-540	PPT/ BB.
40	Packed columns: Types of packing	T1: Ch 2; P no 541-546	PPT/ BB.
41	Packed-bed height	T1: Ch 2; P no 547-551	PPT/ BB.
42	Prediction of the height of a transfer unit (HTU)	T1: Ch 2; P no 551-556	PPT/ BB.
43	Prediction of the height of a transfer unit (HTU)	T1: Ch 2; P no 551-556	PPT/ BB.
44	Column diameter (capacity)	T1: Ch 2; P no 556-563	PPT/ BB.
45	Column internals, Wetting rates	T1: Ch 2; P no 563-570	PPT/ BB.
46	Solvent extraction: Type of extraction	T2: Ch 14; P no 481-482	PPT/ BB.
47	Liquid-liquid extraction	T2: Ch 14; P no 482-487	PPT/ BB.
48	Extraction equipment	T2: Ch 14; P no 501-518	PPT/ BB.
49	Extractor design	T2: Ch 14; P no 458-494; 497-500	PPT/ BB.
50	Extraction columns	T2: Ch 14; P no 481-482	PPT/ BB.
Content beyond syllabus covered (if any):			

* Session duration: 50 mins



Sub. Code / Sub. Name: Sub. Code / Sub. Name: CH18604/ Process Equipment Desfgn I

Unit: III

Unit Syllabus: Heat Transfer Equipments; Heat Exchangers: Basic design procedure and theory, Overall heat-transfer coefficient, Fouling factors, Shell and tube exchangers: Mean temperature difference, general design considerations, Tube-side heat-transfer coefficient and pressure drop(single phase), Shell-side heat-transfer and pressure drop (single phase).Condensers: Heat-transfer fundamentals, Condensation outside horizontal tubes, Condensation inside horizontal tubes, Condensation of steam, Mean temperature difference, Pressure drop in condensers. Reboilers: Boiling heat-transfer fundamentals, Pool boiling, Convective boiling, Design of forced-circulation reboilers.

Objective: To impart the knowledge on Shell and tube heat exchangers & Condenser basics and design

Session No *	Topics to be covered	Ref	Teaching Aids
21	Heat Exchangers: Basic design procedure and theory	T1:Ch 12; P no 579-580	PPT/ BB.
22	Overall heat-transfer coefficient, Fouling factors	T1: Ch 12; P no 580-584	PPT/ BB.
23	Shell and tube exchangers	T1: Ch 12; P no 584-598	PPT/ BB.
24	Mean temperature difference, General design considerations	T1: Ch 12; P no 598-605	PPT/ BB.
25	Tube-side heat-transfer coefficient and pressure drop (single phase)	T1: Ch 12; P no 606-612	PPT/ BB.
26	Shell-side heat-transfer and pressure drop (single phase)	T1: Ch 12; P no 612-631	PPT/ BB.
27	Shell-side heat-transfer and pressure drop (single phase)	T1: Ch 12; P no 612-631	PPT/ BB.
28	Condensers: Heat-transfer fundamentals	T1: Ch 12; P no 650. 5 th	PPT/ BB.
29	Condensation outside horizontal tubes	T1: Ch 12; P no 650-652	PPT/ BB.
30	Condensation inside horizontal tubes	T1: Ch 12; P no 656-657	PPT/ BB.
31	Condensation of steam, Mean temperature difference	T1: Ch 12; P no 657-663	PPT/ BB.
32	Pressure drop in condensers	T1: Ch 12; P no 663-669	PPT/ BB.
33	Reboilers: Boiling heat-transfer fundamentals	T1: Ch 12; P no 669-674	PPT/ BB.
34	Pool boiling, Convective boiling	T1: Ch 12; P no 674-680	PPT/ BB.
35	Design of forced-circulation reboilers	T1: Ch 12; P no 681-686	PPT/ BB.

Content beyond syllabus covered (if any) : Video lecture on various types of condenser and heat transfer equipments used in industries



Sub. Code / Sub. Name: Sub. Code / Sub. Name: CH18604/ Process Equipment Design I

Unit: IV

Unit Syllabus: Types of fluid movers and applications, Pumps: Type, selection, performance curves, pump efficiency, NPSH, Head calculations, & power calculation. Compressors: Type, selection, performance curves, Head calculations and power calculations. Vacuum system: Type and selection. Valves: Type and selection. Safety valves: Types and selection. Drivers for moving equipments.

Objective: To understand fluid moving equipments like pumps and its design considerations

Session No *	Topics to be covered	Ref	Teaching Aids
9	Types of fluid movers and applications, Pumps	T2: Ch 7; P no 119-121.	PPT/ BB.
10	Type, selection, performance curves	T2: Ch 7; P no 126-137	PPT/ BB.
11	Pump efficiency	T2: Ch 7; P no 137-150	PPT/ BB.
12	NPSH	T2: Ch 7; P no 123,137	PPT/ BB.
13	Head calculations, & power calculation	T2: Ch 7; P no 123,137	PPT/ BB.
14	Compressors: Type, selection	T2: Ch 7; P no 132-137	PPT/ BB.
15	Performance curves	T2: Ch 7; P no 134-137	PPT/ BB.
16	Head calculations and power calculations	T2: Ch 7; P no 137-150	PPT/ BB.
17	Vacuum system: Type and selection	T2: Ch 7; P no 150-155	PPT/ BB.
18	Valves: Type and selection	T2: Ch 7; P no 119-123	PPT/ BB.
19	Safety valves: Types and selection	T2: Ch 7; P no 120	PPT/ BB.
20	Drivers for moving equipments	T1: Ch 4; P. no. 53-59	PPT/ BB.
Content beyond syllabus covered (if any) : Debate on selection of pumps and compressors			



Sub. Code / Sub. Name: Sub. Code / Sub. Name: CH18604/ Process Equipment Design I

Unit: V

Unit Syllabus: Piping & Instrumentation and Site Selection, P and I diagram, valve selection, pumps, mechanical design of piping systems, pipe size selection, Instrumentation and control objectives, Automatic-control schemes, Plant location and site selection, Site layout, Plant layout, Utilities, Environmental considerations.

Objective: To learn the concepts of piping and instrumentation diagram and site selection

Session No *	Topics to be covered	Ref	Teaching Aids
51	Piping & Instrumentation and Site Selection	T1: Ch 5; P. no. 179-180	PPT/ BB.
52	P and I diagram	T1: Ch 5; P. no. 180-182	PPT/ BB.
53	Valve selection, pumps	T1: Ch 5; P. no. 182-187	PPT/ BB.
54	Mechanical design of piping systems, pipe size selection	T1: Ch 5; P. no. 187-197	PPT/ BB.
55	Instrumentation and control objectives	T1: Ch 5; P. no. 197-198	PPT/ BB.
56	Automatic-control schemes	T1: Ch 5; P. no. 198-199	PPT/ BB.
57	Plant location and site selection, Site layout	T1: Ch 14; P. no. 816-820	PPT/ BB.
58	Plant layout	T1: Ch 14; P. no. 820-821	PPT/ BB.
59	Utilities	T1: Ch 14; P. no. 824-826	PPT/ BB.
60	Environmental considerations	T1: Ch 14; P. no. 826-830	PPT/ BB.

Content beyond syllabus covered (if any): Video lecture in automatic control systems and environmental considerations related to design

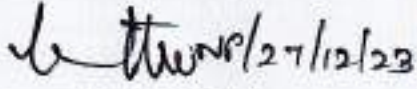
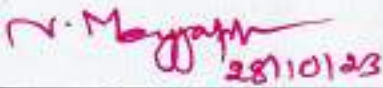


TEXTBOOKS:

- 1.J. M. Coulson, J.Richardson, "Chemical Engineering", Vol. 6, Asian Books Printers,Fourth edition 2005.
- 2.James R. Couper, James R. Fair & W. Roy Penney, "Chemical Process Equipment -Selection and Design", Published by Butterworth-Heinmann, 2007.

REFERENCES:

- 1.R.H.Perry,"Chemical Engineers Handbook",Seventh Edition, McGrawHill, 2004.
- 2.S B Thakore, B I Bhatt, "Introduction to Process Engineering and Design", Tata McGraw Hill, 2007.
- 3.B.C.Bhattacharyya,"Introduction to Chemical Equipment Design",CBSPublishers & Distributors, New Delhi, 2003.

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