SECOND SEMESTER 2020-2021
COURSE HANDOUT

Date: 16.01.2021

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No : **CHE F419**
Course Title : **CHEMICAL PROCESS TECHNOLOGY**
Instructor-in-Charge : **SMITA RAGHUVANSHI**

1. Course Description:

Process synthesis concepts for flow sheet generation - Unit operations and unit processes, General principles applied in studying a chemical industry; Chemical processes based on agricultural and raw materials - sugar, starch, alcohol, cellulose, etc; Selected technologies for chemicals from inorganic chemical industry covering contact process, fertilizer, chloral alkali, cement and lime; Natural product industry covering manufacture of oils, soaps, detergents, paper and pulp, Coal and various coal-chemicals, Petroleum and petrochemical products, Raw materials and principles involved in the production of olefins and aromatics, Acetylene, Butadiene and typical intermediates from olefins and aromatics such as ethylene glycol, ethyl benzene, phenol, cumene and DMT/PTA, Dyes and pharmaceuticals.

2. Scope and Objective of the Course:

The aim of the course is to bring alive the concepts forming the basis of the Chemical Process Industry and to give a solid background for innovative processes. The main focus would be on the raw materials, development of flow sheets, synthesis and detailed analysis of the processes. The course begins with the coverage of refinery based operations, followed by steam reforming process and syn gas production based processes. The course also introduces various development in homogeneous & heterogeneous catalyst based processes. The portion covers process intensification & other process development. The course also deals with few traditional processes such as sulphuric acid production, nitric acid production and various other processes. It enables the students to integrate the fundamental knowledge learnt in other courses and apply the same in various application based processes. It helps them to apply this knowledge and understanding in the industrial processes.

3. Text Books:

TB: "Moulijn A J., Makkee, M., Diepen, A V., "Chemical Process Technology, 2nd Edition" Wiley, 2013.

4. Reference Books:

R1: Rao M G., Sittig M., "Dryden's Outlines of Chemical Technology for the 21st Century", East West Press, 3rd Ed., 1997.
R2: Austin G T., Shreve R.N., "Shreve`s Chemical Process Industries", McGraw Hill, 5th Ed., 1984.
R3: Research Papers from Refereed Journals / Resources- Chemical Engg World, Chemical Industry Digest, Chemical Weekly, etc.
R4: Dynamic addition of reference material will be shared.

5. Course Plan:

Module Number	Lecture session	Reference	Learning Outcomes
1. Overview of the course; About chemical industry & Oil & refinery sector 13 lectures	L1.1 -1.2 Introduction to the course, Chemical Industries, Structure of chemical industry, Raw materials used	Ch 1 & Ch2 T1	To understand about chemical industry and a detailed understanding of various processes .
	L1.3 Chemical Industry & Flow sheet development	Ch 2 T1 & Web resources	
	L1.4 – 1.6 Oil refinery-an overview, Physical and Thermal Processes, Catalytic Processes, Treatment of refinery gas streams	Ch 3- T1	
	L1.7 – 1.10 Cracking reactions, Kinetics involved, Industrial Process, Product Processing	Ch 4 - T1	
	L1.11 – 1.13 Production of Syn gas, coal gasification, purification and adjustment of synthesis gas	Ch 5 - T1	
2. Sulphuric acid process 3 lectures	L 2.1 – 2.3 Chamber process, Contact process, Modern sulphuric acid production Plant, Catalyst deactivation	Ch II A - R1, Ch 7 - T1	To understand the chronological development in the sulfuric acid production (Inorganic bulk chemicals)
3. Ammonia process 3 lectures	L3.1-L3.3 Ammonia oxidation processes: Mono Pressure and Mixed pressure processes	Ch II E - R1, Ch 7 - T1	To understand the chronological development in the Nitric acid production (Inorganic bulk chemicals)
4. Methanol production process 2 lectures	L4.1-4.2 Methanol production process	Ch 6 - T1	To understand the production of bulk chemicals and synthetic fuels derived from syn gas
5. Catalysts based processes 5 lectures	L5.1 – 5.3 To understand the concept of homogeneous catalysis L 5.4 – 5.5 To understand the concept of heterogeneous catalysis	Ch 9 T1 Ch 10 – T1	To understand about homogeneous and heterogeneous catalysts system
6. Catalytic reactors 2 lectures	L6.1 – 6.2 Introduction, Micro reactors, Structured catalytic reactors	Ch 14 - T1	To understand the concept of intensification of process
7. Biotechnology based processes 5 lectures	L7.1 – 7.3 Conversion process, fermentation technologies, enzyme technology	Ch 13 - T1	To understand the biotechnology processes
	L7.4-7.5 Biofuels, Different types of fuels	Ch 7 - T1	To understand the processes for conversion of biomass
8. Pulp & paper making process 2 lectures	L 8.1 – 8.2 Kraft Process, sulfite Process, Mechanical Pulping; Paper making, Production of lignin chemicals	Ch III F, R1	To understand the pulp and paper production processes

10. Cement process 1 lecture	L 10.1 Dry and wet cement manufacturing processes	Ch II K, T1	To understand the cement manufacturing processes
11. Scaled up process 2 lectures	L 11.1-11.2 Introduction, Pilot plants/mini plants, scale up concepts	Ch 15 - T1	To finally conclude with overall process development

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 min	30	<TEST_1>	OB
Comprehensive Examination	3 h	40	<TEST_C>	OB
Surprise quiz (Best 4 out of 6)	15 min	20	During lecture hour (3 will be conducted before mid-sem and 3 will be conducted after mid-sem)	OB
Class Assignment (Two Assignments)	-	10 (5%+5%)	One before mid sem & one after mid sem	OB

7. Consultation Hour: Consultation hour will be decided while conducting the class.

8. Notices: All Notices would be put up on Google class room.

9. Make-up Policy:
Make-up will be granted for genuine cases only. Prior permission of IC is compulsory. ***No make up for class based quiz component and assignments; if any.***

10. Note (if any):
- Students have to adhere to the class timings and participate in the class room discussion.

Instructor-in-charge
Course No. CHE F419