**SECOND SEMESTER 2022-2023**

**Course Handout (Part II)**

Date: 16/01/2023

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

***Course No.* : CHE F419**

***Course Title* : Chemical Process Technology**

***Instructor-in-charge* :** Ramendra Kishor Pal

**1.** **Scope and Objective of the Course:**

The aim of the course is to study the general principles involved in Chemical manufacturing processes and their application to specific chemical industries relevant to the Indian economy. The course will provide detailed processing (from raw materials to products) of agrochemicals, chlor-alkali, petroleum, petrochemicals, coal-based industries, cement, synthetic polymers, paints & coating, pharmaceuticals, Li-ion batteries, green-H2, and silicon production for microelectronics. Emphasis is placed on understanding the flow sheets and troubleshooting.

**2. Learning Outcomes:**

* Understand the Unit operations and Unit processes involved in Chemical process technologies
* Apply the knowledge of Separation processes 1 & 2 and Kinetics & Reactor Design in understating the chemical process
* Understand the Engineering problems in the processing of chemical products
* Understand the need for flow sheets in manufacturing a product (like fertilizers, Petroleum, and Paint)

3. **Text Book-T1:** “Dryden’s **Outlines of Chemical Technology** for the 21st Century" Edited by M. Gopala Rao and Marshall Sittig. East West Press, 3rd Ed., Reprint 2010.

**Reference Book**

**R1:** Shreve’s Chemical Process Industries by George T. Austin, McGraw Hill, 5th Edn., Reprint 2017

1. **Course Plan:**

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| --- | --- | --- | --- |
| **Lect. No.** | **Learning Objectives** | **Topics to be covered** | **Ref. Chap./ Book** |
| 1 | Overview of the course |  |  |
| 2 | To know the present status of chemical industries in India | Classification of Chemical Industries  Chemical Industries – Facts and figures | Ch-I A-B, T1  Class notes |
| 3 | Concepts of unit operations and unit processes.  General Principles applied in Chemical Industries | Lab tour: Drying (Try drier), Filtration (rotary drum vacuum filtration), Sedimentation, Adsorption, Evaporation, Size reduction (fibres, particles), Size enlargement (Granulation) | Ch-I C-D, T1 |
| 4-8 | To understand the Nitrogen-based fertilizers production | Urea Production Processes; Ammonium Nitrate and Nitrolime Production Process | Ch-II E, T1; R1 |
| 9-12 | To understand the importance of NPK fertilizer and its production | Production of Phosphoric acid, Superphosphate and DAP | Ch-II F, T1; R1 |
| 13-14 | To understand the cement manufacturing process | Cement properties, limestone beneficiation, Portland cement manufacturing | Ch-IIK, T1 |
| 15-18 | To understand the crude oil refining processes | Origin and classification of petroleum; Refining operations (atmospheric and vacuum distillation), Catalytic cracking, Reforming | Ch-III H, T1; R1 |
| 19-20 | To understand the petrochemical processes | Chemicals from C1 compounds, Chemicals from C2 compounds (Ethylene and acetylene production) | Ch-IV B-D, T1; R1 |
| 21-23 | To understand the processes in polymer technology (thermoplastics and thermosets including fibres) | Modes of Polymerization, Structure-properties of polymers, Processing of polyolefins (PE), PVC, Phenol-formaldehyde and Epoxy resins. Production of viscose, Nylon, Polyester and Carbon fibres. | Ch-V A-B, T1, R1, notes |
| 24-25 | Chlor-Alkali Industries | Soda Ash, Sodium hydroxide, Chlorine | Ch-II H, T1, R1 |
| 26-27 | To understand the coal-based technologies | Coking of coal, Coal gasification, Hydrogenation of Coal, Ash | Ch-III G, T1; R1 |
| 28-34 | Paints and Coatings | Dispersions, resins, additives in Paints, varnishes, powder coat, EMI shield, Coating failure | Ch-III C, T1, R1 Class notes |
| 35-36 | Energy Industries | Production of Li-ion batteries and Green- H2 | Class notes |
| 37-39 | Pharmaceutical Industry | Development and Manufacture of API, Manufacture of paracetamol tablets, Manufacture of flu vaccine | Ch-IV H, T1, R1, Class notes |
| 40 | Production of Silicon wafers for microelectronics | Silicon production, crystal growth, and Basic steps of wafer production | Class notes |

1. **Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Evaluation Component** | **Duration** | **Weightage (%)** | **Date &Time** | **Nature of Component** |
| Mid-semester test | 90 min | 25% | 17/03 4.00 - 5.30PM | CB |
| Quizzes (2 best of 3) | 40 min | 15% | TBA | OB |
| Project Seminar |  | 20% | TBA | OB |
| Comprehensive Exam | 3 hours | 40% | 18/05 AN | CB |

NOTE: A total of three quizzes will be conducted. Two best of three will be considered.

6. **Chamber Consultation Hour:** To be announced in the class. **(Chamber: D 321)**

7. **Notice:** Notice will be displayed on CMS

**Make-up policy**: No make-up for the quizzes in any case. Make-up for the mid-semester test and comprehensive exam may be granted only if **the student maintains a minimum of 50% attendance in class** and has genuine reasons not to appear in the regular test. Prior permission from IC is a must for any make-up.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**

Dr. Ramendra Kishor Pal

CHE-F41 (Chemical Process Technology)