INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

End-Autumn Semester Examination 2022-23

Date of Examination:_____ Session: (FN/AN) Duration: 3 hrs.

Full Marks: 50 Subject No.: **CH30014**

Subject: **Chemical Process Technology** Department: Chemical Engineering

Specific charts, graph paper, log book etc., required: No

Special Instructions (if any): Answer all the questions

Part I

1. Differentiate between double decomposition and condensation reactions (mention one reaction from each category). How can one synthesize H_2SO_4 using iron pyrites as the starting material? Describe the importance of all the equipments involved in the synthesis of H_2SO_4 by contact process. Draw a conceptual flow diagram of the synthesis of H_2SO_4 by contact process. Mention the detailed reaction conditions (T, P, catalyst, composition of the inlet and outlet streams).

[1.5+ 2+1.5+3+1]

2. Differentiate between branched chain and the network/gel forming polymers (Draw the reaction steps involved in the synthesis of branched chain and network/gel polymers). Write down the detailed steps involved in the synthesis of bakelite and graphitic carbon nitride (mention the reaction steps). Draw the flow diagram for the synthesis of polyethylene by low pressure process (mention detailed steps, reaction conditions, composition of the inlet and outlet streams).

[2+2+2]

3. What is platforming operation? Describe all the reactions involved in the platforming operation (Don't forget to mention the name, structure of the reactants and products). Describe the platforming operation with a conceptual flow diagram. What is hydrocracking reaction? Write down the reactions involved in the hydrocracking operation. Draw the flow diagram of a typical hydrocracking unit mentioning the reaction conditions, inlet and outlet streams.

[1+2+2.5+1+1+2.5]

Part II

4. a) What do you understand by Hardness of water? b) How the hardness of water is expressed? c) Name two units of water hardness analysis. d) Discuss in short, how ion

exchange method is effective in removing objectionable ions in water (write one example of chemical reaction equation for each type of ion exchange process).

[1+1+1+5=8]

5. a) What is synthesis gas? b) Outline in brief, how steam reforming process is practiced for production of synthesis gas. [1+5=6]
6. a) Mention any of the important chemical which can be produced by utilizing synthesis gas. b) Describe in brief, with diagram, the process of production of that chemical.

[1+6=6]

7. a) What are the raw materials for production of urea? b) What is the important use of it? c) In which forms urea is marketed? Name the processes by which those forms prepared.

[1+1+3=5]