

Total No. of Questions : 12]

SEAT No. :

P1097

[Total No. of Pages :3

[4659] - 264

B.E. (Petrochemical Engineering)

b - CATALYST SCIENCE AND TECHNOLOGY

(2008 Course) (Semester - II) (Elective - IV) (412411(B))

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answers to the two sections should be written in Separate answer books.*
- 2) *Answer three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

SECTION - I

- Q1)** a) Discuss importance of Activity, Selectivity and Turnover Frequency for any commercial catalyst. [8]
- b) Name four important Catalyst used in Petrochemicals and Refinery Industries and mention the overall benefits attained due to their usage.[8]

OR

- Q2)** a) With help of suitable example explain the operation of Homogeneous Catalysts. Also indicate their benefits and disadvantages. [8]
- b) Discuss the important characteristics needed for a promising catalyst to be considered for actual industrial operation. [8]

- Q3)** a) Derive BET Equation for adsorption. Highlight importance of all the terms. [10]
- b) Differentiate between chemisorptions and physical adsorption. [6]

OR

- Q4)** a) With help of neat diagram explain coke deposition in the pores of catalyst. How can it be removed? In this context clearly discuss how catalyst deactivation differs from the above mentioned phenomena. [8]

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- b) Explain the L-H model of Catalytic Reaction. How does it differ from Riedel model-Explain with help of real life examples. [8]

- Q5)** a) Two samples of silica-alumina cracking catalysts have particle densities of 1.126 and 0.962 g/cm³ respectively as determined by mercury displacement technique. The true density of solid material in each case is 2.37 g/cm³. The surface area of first catalyst is 467 m²/g and that of the other is 372 m²/g. Which catalyst has larger pore radius? [6]
- b) Differentiate between Textural and Structural Promoters - give examples. [6]
- c) Discuss the principle of XRD. Explain its importance in Catalyst characterization. [6]

OR

- Q6)** a) With help of suitable example explain impregnation method of catalyst manufacture. [6]
- b) What are the key characteristics of Supports? Name three important supports. [6]
- c) With help of neat diagram explain the methodologies followed to obtain pore size and pore size distribution of commercial catalysts. [6]

SECTION - II

- Q7)** a) What are supported metal catalysts? Discuss the structure of these catalysts. Also indicate their synthesis and characterization issues. [10]
- b) What is shape selectivity in Zeolites? With help of neat diagram and suitable examples - discuss the importance of shape selective zeolites in petrochemical industry. [8]

OR

- Q8)** a) Define molecular sieves. With help of neat diagram discuss the special structure possessed by molecular sieves. Indicate their field applications. [9]
- b) With help of suitable diagram explain the sintering phenomena on supported metal catalyst. Discuss the methodology to be adapted to reduce sintering in case of commercial catalyst. [9]

- Q9) a)** Draw a neat diagram of trickle bed reactor. Write down important reactions occurring. Indicate process condition. Comment on the catalyst employed for the process and its regenerability issues. [8]
- b) What is reformer catalyst? Indicate its key characteristics. With help of neat diagram explain the process followed in a conventional reformer indicating the reactions occurring inside. [8]

OR

- Q10)a)** With help of suitable examples explain the importance of Zeolites in Refinery Complexes. [8]
- b) Name the catalysts used for isomerization process. Indicate the chemistry. Discuss the industrial operation with a special mention on operating conditions. [8]

- Q11)a)** Discuss ammonia manufacture with special emphasis on Catalyst and its deactivation issues. Draw neat diagram of reactor and indicate the process in brief. [8]
- b) What is Fischer Tropsch Synthesis? Write down representative reactions and the highlight importance of the process. Give a detailed analysis of the catalysts suitable for the process. [8]

OR

- Q12)a)** With help of neat diagram explain ethylene oxide manufacture from ethane. Indicate the safety issues, type of reactor to be used and catalyst employed. [8]
- b) Compare packed bed, fluidized bed and slurry bed reactors for industrial operations. [8]

