

**M.Tech (PT) Degree II Semester
CHEMICAL ENGINEERING
(PROCESS ENGINEERING)
(2005 Admission)**

End Semester Examination, February 2007

CHEP 3202 CATALYSIS AND SURFACE PHENOMENA

Answer *all* questions.
All questions carry *equal* marks.

Time: 3 hours]

[Maximum marks : 100

I (a) What is the importance of catalysis in industrial operations?. Discuss the broad classification of catalysis with suitable examples for homogenous and heterogeneous catalysis.

(b) Enzymes are *biocatalysts*. Substantiate the statement with supporting evidence for enzyme activity important in industrial production with relevant examples.

OR

II (a) Heterogeneous catalysis are always preferred in industrial operations over other catalyses because of the easiness for separation. Describe the importance of common heterogeneous catalysis with merits and demerits.

(b) Biocatalyses are best described by Monod kinetics . Why?

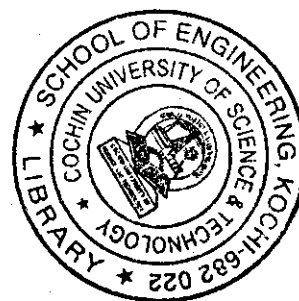
III (a) How will you implement BET theory of multilayer adsorption of gases on catalysts and other porous materials as a method for the determination of surface area.

(b) How will you identify the regions of micropore filling and mesopores filling in a typical isotherm plot of a porous catalyst?

OR

IV (a) What are the common types of isotherms given by porous materials and catalysts ?

How will you distinguish monolayer capacity from micropore volume?



(b) Describe in short notes how the following instrumental techniques will support in the characterization of catalysts.

(i) FTIR (ii) XRD (iii) XPS (iv) Raman Spectrum (v) ESR

V (a) What is the chemistry and thermodynamics behind the adsorption of molecular entities on the material surfaces?

(b) Discuss the theory and application of Freundlich and Langmuir isotherms.

OR

VI (a) What is Dubinin's equation? How it is generally used for the determination of micropore volume?. How the half widths of the pores are determined?

(b) How is external surface area of porous materials determined?. Discuss α_s method.

VII (a) Discuss the importance of internal and external mass transfer in solids. Give the suitable expressions with the definitions of the terms involves.

(b) How is these mass transfer phenomena affects the material performance in reactor operations?.

OR

VIII (a) What are fluidized bed reactors? . Give a brief description of the design aspects and operation procedure of a typical fluidized reactor in a manufacturing process.

(b) What is meant by Effectiveness factor and Thiele modulus?

IX (a) What is meant by catalyst poisoning? How the inhibitory effect of catalytic poisons can be controlled? Explain with suitable examples.

(b) What are major kinetic models used in catalysis?. Describe the kinetics of deactivation.

OR

X (a) How is quality control of a process can be ensured using control charts such as Schwartz Chart ?. How is parameter estimation and sensitivity analysis is done ?

(b) What are photo catalytic reactions? . Describe two important reactions with suitable examples. How Arrhenius equation is useful for deducing thermodynamic parameters of an uptake process?