M.Tech. / Sem. III
CHEMICAL SYNTHESIS AND PROCESS TECHNOLOGIES
(Admission of 2008 and onwards)

Time : 2 Hours
Maximum Marks : 38

(Write your Roll No. on the top immediately on receipt of this question paper.)

Answer all questions of any three parts.

Part I

A (06) Discuss the origin of the pH dependent and independent acidic sites in clay minerals?

B (06) List out the h, k, l values for the first ten reflections of a solid crystallizing in a body centered cubic structure.

[P.T.O.]
Part II

A  (06) Describe a method by which the surface acidity and cation exchange capacity of a naturally occurring clay sample can be estimated.

B  (07) With the help of a suitable example, discuss how the radius ratio of the ions involved can be useful in predicting the structure of a solid. How do you estimate the average crystallite size of a solid sample from its powder X-ray diffraction patterns?

Part III

A  (06) With the help of an appropriate diagram discuss the structural differences between the Amphibole and Pyroxene minerals.

B  (07) Discuss the reason behind the shape and size selectivity of zeolite catalysts. Is ZSM 5 a better Catalyst for fluid cracking? Justify your answer.
Part IV

A  (06) Predict the structure and geometry of any 03 of the following.

\[ \text{[Fe}_4\text{C(CO)}_{12}]^{-2}, \text{[H}_3\text{Ru}_4\text{(CO)}_{12}]^{-1}, \]

\[ \text{[OS}_{10}\text{C(CO)}_{24}^{-2}, \text{[Os}_8\text{(CO)}_{22}]^{-2}, \text{[Mn}_3\text{(CO)}_{14}]^{-1} \]

B  (06) The lattice parameters of a primitive cubic zeolite is 4.200 Å, calculate the 2θ positions and d values of the 301, 400 and the 111 reflections determined by copper radiation (\( \lambda = 1.5405 \text{Å} \)).