

(2 Hours)

[ Total Marks : 75

- N.B. :** (1) Question No. 1 is compulsory.  
 (2) Attempt any **four** questions from remaining **six**.  
 (3) **Figures** to the **right** indicate **full** marks.  
 (4) **All** questions carry **equal** marks.

1. Attempt the following any **five** — 15
  - (a) Define Octane number and Cetane number. Give their significance.
  - (b) Define corrosion. Explain the basic reason of metallic corrosion.
  - (c) Give the composition, properties and uses of German Silver.
  - (d) Give classification of composite materials.
  - (e) Define catalysis. Explain different types of Catalysis with one example each.
  - (f) Write a note on 'Green Solvents'.
  - (g) A current of 0.5 A was passed through a Solution of  $\text{CuSO}_4$  for 1 hour. Calculate the amount of copper deposited at cathode.
2. (a) What is cracking ? Describe fixed bed catalytic cracking in detail. 5  
 (b) 3.2 gms of coal in Kjeldahl's experiment evolved  $\text{NH}_3$  which was absorbed in 40 ml of 0.5 N  $\text{H}_2\text{SO}_4$ . After absorption, the excess acid required 16 ml of 0.5 N KOH for complete neutralization. 2.5 gms of coal sample in quantitative analysis gave 0.42 gm  $\text{BaSO}_4$ . Calculate the % of N and S in the sample. 5  
 (c) Explain 'Wet Corrosion' in neutral medium with schematic diagram and mechanism. 5
3. (a) Explain adsorption theory of heterogeneous catalysis. 5  
 (b) Write a note on the following — 5
  - (i) Atom Economy
  - (ii) Compacting and Sintering.
4. (a) Explain concentration cell corrosion with the help of a suitable example. 5  
 (b) Write a note on structural composites. 5  
 (c) A gas has following composition by volume 5  
 $\text{H}_2 = 20\%$ ,  $\text{CH}_4 = 6\%$ ,  $\text{CO} = 22\%$ ,  $\text{CO}_2 = 4\%$ ,  
 $\text{O}_2 = 4\%$  and  $\text{N}_2 = 44\%$ , find the volume of air actually required per  $\text{m}^3$  for complete combustion of this gas.

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5. (a) Describe the adsorption and catalytic properties of zeolite. 5  
(b) Write a note on the following ceramic materials. 5  
(i) Alumina  
(ii) Silicon carbide.  
(c) What are composite materials ? Describe fibre reinforced composites. 5
6. (a) Explain conventional and green route of manufacturing of Adipic acid. By this reaction which principle of green chemistry is shown ? 5  
(b) What is cathodic protection ? Describe impressed current method of corrosion control. 5  
(c) A coal sample has the following composition by weight C = 85%, H = 5%, S = 2%, O = 5%, and Ash = 3%. Calculate the minimum quantity of air required both by weight and volume for the complete combustion of 2 kgs of coal. 5
7. (a) Discuss the effect of the following factors on the rate of corrosion. 6  
(i) Nature of corrosion product  
(ii) Overpotential/Overvoltage  
(iii) Relative area of Anode & Cathode.  
(b) Calculate the gross and net calorific value of coal having following composition. 4  
C = 80%, H = 7%, O = 3%, S = 3.5%  
N = 2.1 % and ash = 4.4 %.  
(c) An electric current is passed through two cells arranged in series containing  $\text{AgNO}_3$  and  $\text{ZnSO}_4$  solutions with platinum electrodes. If  $2.16 \times 10^{-4}$  kg of silver is deposited in  $\text{AgNO}_3$  / pt cell, calculate the amount of Zn deposited in  $\text{ZnSO}_4$  / pt cell. (At. wt. of Ag = 108, Zn = 65). 5