

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

B. TECH-M.TECH DUAL DEGREE 2nd SEM (EE, CST, ETC, IT) EXAMINATION, 2018

Chemistry (CH-1201)

FULL MARKS : 70

TIME : 3 Hrs

Use separate answer scripts for each half

FIRST HALF

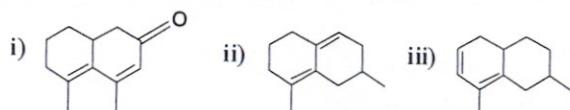
(Question No. 1 is compulsory)

1. (a) Write down the name and structure of a radical initiator. Write a short note on chemical shift?
 (b) Six metal-ligand bonds in $\text{Fe}[(\text{CN})_6]^{3-}$ are uniform but these are not uniform in $\text{Fe}[(\text{H}_2\text{O})_6]^{2+}$ complex – explain.

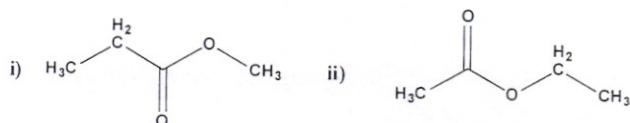
(1+2)+3

Unit -I [answer any Two]

2. (a) Calculate the λ_{\max} in nm each of the following compounds:

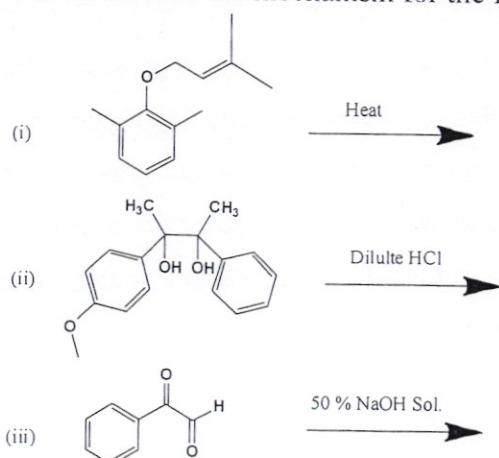


(b) What is enantiomeric excess (e.e.)?

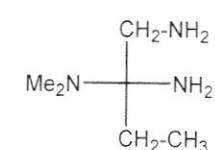
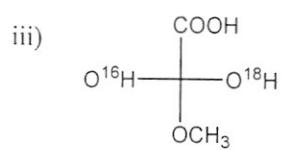
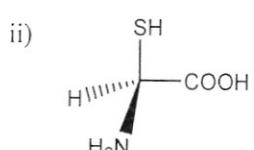
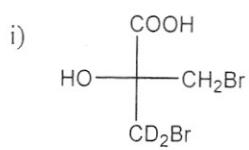
(c) Draw the $^1\text{H-NMR}$ spectra of the following two isomeric compounds and show their splitting pattern with intensity ratio.

(1½×3)+1½+(2×2)

3. (a) Predict the product(s) and write down the mechanism for the following reactions:



(b) Find out the absolute configuration (R or S) of following compounds:



(3×2)+(4×1)

4. (a) Classify polymers on the basis of *Tacticity*.

(b) Calculate the number-average and weight-average molecular mass for a polymer sample containing 205 molecules of molecular weight 1099, 301 molecules of molecular weight 10005 and 500 molecules of molecular weight 100011.

(c) Differentiate between addition and condensation polymerization with examples.

(d) What is thermosetting plastic?

3+3+3+1

Unit-II [answer any Two]

5. (a) In the spectrochemical series, π -acceptor ligands produce large values for Δ_o whereas π -donor ligands produce small values for Δ_o – explain.

(b) Explain the variance in ligand field strength: $\text{F}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$

(c) Hydration energy of the divalent ions of the first transition series exhibits a double humped curve when plotted against their d^n configuration though a smooth curve can be obtained considering only Ca^{2+} , Mn^{2+} and Zn^{2+} – explain.

4+2+4

6. (a) $[\text{Fe}(\text{dtc})_3]$ is found to be diamagnetic at low temperature and paramagnetic at high temperature – explain the phenomenon. [$\text{dtc} = \text{N}, \text{N}'\text{-diethyldithiocarbamate}$]

(b) What are the two selection rules applicable for $d-d$ transition? Explain them.

(c) $[\text{CoF}_6]^{3-}$ exhibits one $d-d$ transition with two distinct maxima – explain the observation.

4+4+2

7. (a) Cis-platin is a well established cancer drug, however, it has several drawbacks. Mention the drawbacks and give name and structure of a new generation platinum drug.

(b) What are the essential criteria that a radioisotope must satisfy to be considered for radiodiagnosis? How can cancerous thyroid cells be treated with a radioisotope?

(c) Write names and structures of a lanthanide complex and a vanadium complex used in diagnostic application and as insulin mimetic, respectively.

3+(2+2)+(1½+1½)

SECOND HALF
(Answer Question No. 11 and any two from the rest)

8. Name the necessary steps of a chain reaction. Write down the mechanisms of the thermal decomposition of acetaldehyde indicating each step. Show that the chain length of the decomposition reaction is given by $k_{\text{obs}} [\text{CH}_3\text{CHO}]^{1/2}$.

2+2+6

9. (a) What is the Michaelis-Menten model for enzyme-catalyzed reaction kinetics? Explain topological feature of a typical variation of initial rate versus initial substrate concentration for the enzyme reaction using this model.

(b) Write down the spontaneous reactions for the cell configuration
 $\text{Cd}/\text{Cd}^{+2} // \text{KCl}/\text{Hg}_2\text{Cl}_2, \text{Hg}(\text{s})$

If $E_{\text{Cd/Cd}^{+2}}^0 = 0.402$ and $E_{\text{calomel}}^0 = 0.2680$ V, calculate the equilibrium constant for the cell reaction and free energy change under standard condition.

5+5

10. (a) Illustrate the following :

(i) Double layer structure at the electrode solution interface.

(ii) Redox electrode.

(b) What is the function of Polymer electrolyte membrane (PEM) in a $\text{H}_2\text{-O}_2$ fuel cell?

(c) What are the intercalated host structures in Li-ion battery?

(d) At 18°C molar conductivity of a dilute AgNO_3 solution is $115.8 \text{ ohm}^{-1} \text{ cm}^2$ and transport numbers of Ag^+ and NO_3^- ions are 0.466 and 0.534 respectively. Calculate ion conductance and mobilities of the two ions.

2+2+3+3

11. (a) The rate constant for the given value of E_a (80 kJ mol^{-1} at 300K) increase about 3 for ten degree rise in temperature. Comment and Justify, given $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$.

OR

- (b) What are the components of a Pb-acid battery? Write down the charging-discharging reaction of such battery.

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