INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

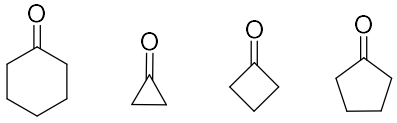
B.TECH **2nd SEM END-SEMESTER** (Group I–IV) EXAMINATION, JULY 2021

Chemistry (CH1201)

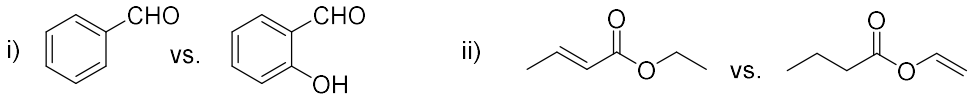
Time: 1h 30 min. **Full Marks: 50**

Answer all questions

1. (a) Arrange the following compounds in decreasing order of their C=O stretching frequencies of IR spectra with appropriate explanation:



(b) Give a clear pictorial representation of following bending vibration modes of CH_2 moiety:
i) rocking ii) scissoring iii) wagging and iv) twisting.
(c) How can you distinguish the following pair of compounds with the help of IR spectroscopy:



(d) Why trimethylsilane (TMS) is taken as internal standard in ^1H NMR spectroscopy? Calculate the Chemical Shift (δ) in ppm for a proton that has resonance 128 Hz downfield from TMS on a spectrometer that operates at 60 MHz.
(e) Write down the intensity ratio of a septuplet proton using Pascal's triangle.
(f) How can you distinguish the following pairs of isomeric compounds by means of ^1H NMR spectroscopy?

(g) Describe the synthesis of nylon 6,6 starting from 1,3-butadiene.
(h) In a polypropylene polymer, there are 200 molecules of molecular weight 10^3, 300 molecules of molecular weight 10^4 and 400 molecules of molecular weight 10^5. Find out, $\overline{M}_n$, $\overline{M}_w$ and DP_n.

[2+(½×4)+2+(1+2)+2+2+2+2]

2. a) Mention the diseases that will occur due to both deficiency and excessive accumulation of copper in the body.
b) Give a reaction scheme to show how Lewisite attacks free enzymes in the body and then demonstrate how British anti-Lewisite removes Lewisite from the body.

or

Draw a graph showing the dependence of metabolic activity on the concentration of essential elements and explain the different segments of the graph.
c) Give the full names and structures of the two chelating agents DMSA and DPA used in chelation therapy.

d) Why does *cis*-Platin remains almost passive in blood but becomes active after reaching the cytoplasm?
e) Why ^{99m}Tc is considered most desirable to be used as a radio-diagnostic agent? Which Tc-complexes are selectively taken up by heart tissues?
f) How thyroid gland cancer cells are destroyed by radio-therapeutic technique?
g) Define CFSE and OSSE? Calculate CFSE values for an octahedral Co(II)-complex in both high-spin and low-spin electronic configuration.

[2+3+2+2+2+2+4]

3. (a) A solution of KCl has a conductivity of 0.14088 S/m at 25°C. A cell filled with the solution has a resistance of 4.2156 Ω.
(i) What is the cell constant?
(ii) The same cell filled with a solution of HCl has a resistance of 1.0326 Ω. What is the conductivity of HCl solution?
(b) Consider the following reaction in an electrochemical cell operating at 25°C:
$M + N^+ \rightarrow M^+ + N$
where the activities of the M^+ and N^+ are 0.4 and 0.2 respectively. The standard cell potential is 0.014 V. Calculate the free energy change and configure the cell.
(c) Give an account of the conductometric titration (with a typical plot) of $AgNO_3$ solution with KCl solution.
(d) Illustrate the following:
(i) Standard hydrogen electrode; (ii) Relaxation or asymmetric effect.

[(2+2) + 4 + 4 + 4]