

**POSTGRADUATE FOURTH SEMESTER EXAMINATION, 2022**

**CHEMISTRY**

**Course Code: CHEM 401E**

**Course ID: 41451**

**Inorganic Chemistry Special**

**Time: 2 Hours**

**Full Marks: 40**

*The figures in the right-hand side margin indicate full marks.  
Candidates are required to give their answers in their own words as  
far as practicable*

1. Answer *any five* of the following questions: 2×5 = 10
- (a) What is valinomycin?
  - (b) What is recoil energy in Mössbauer spectroscopy?
  - (c) Give one example of AND logic gate.
  - (d) What are the limitations of Mössbauer spectroscopy?
  - (e) Why caesium carbonate is preferred over caesium compounds in macrocyclisation reactions as basic reagents?
  - (f) What do you mean by  $i_{\text{CORR}}$  and  $E_{\text{CORR}}$ ?
  - (g) What do you mean by self-assembly in supramolecular chemistry?
2. Answer *any four* of the following questions: 5×4 = 20
- (a) (i) Draw the experimental arrangements of Mössbauer Spectrometer.
  - (ii) Draw the decay of Fe which is formed by  $^{57}\text{Co}$  after electron capture. 3+2 = 5
  - (b) (i) What is nonactin? How it acts on bacteria?
  - (ii) How do crown ethers act as phase transfer catalyst? (1+2)+2 = 5
  - (c) (i) Why iron corrodes faster than aluminium, even though iron is placed below aluminium in the electrochemical series?
  - (ii) What is Pourbaix diagram? Write down two limitations of Pourbaix diagram. 2+(1+2) = 5
  - (d) (i) In the Mossbauer spectra, a source emitting at 14.4 KeV ( $3.48 \times 10^{18}$  Hz) had to be moved towards observer at 2.6 mm/sec for resonance. Calculate the shift in frequency between source and observer in MHz.

(ii) The compound  $K_4[Fe(CN)_6] \cdot 3H_2O$  gives single line Mössbauer spectrum with no quadrupole splitting-Explain. 3+2 = 5

(e) (i) What will happen if we coupled iron and Zinc galvanically and dipped the same surface area into the deaerated acid?

(ii) Explain how mixed potential theory helps to understand corrosion problems.

2+3 = 5

(f) Mention the molecular devices in supramolecular chemistry. Define the following with example- (i) molecular wire (ii) molecular switch. 1+2+2 = 5

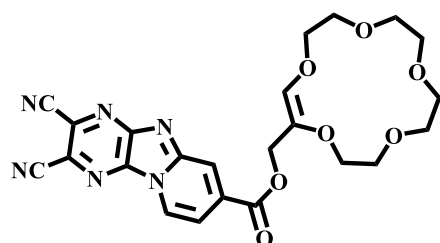
3. Answer *any one* of the followings: 10×1 = 10

(a) (i) Discuss Quadruple shift ( $\Delta$ ) under Mössbauer Spectroscopy.

(ii) Mossbauer spectra of a complex  $[Fe(1,10\text{-phenanthroline})_2(NCS)_2]$  shows two lines at 300K, four lines at 186K and again two lines at 77K. Explain.

(iii) What is catenane? Write two synthetic procedures of catenane. 2+3+(1+4) = 10

(b)(i) A molecular logic gate is shown as bellow



Input:  $Ba^{2+}$ ,  $NCS^-$

(A) Suggest what type of fluorescence response generates by each of the given input and how these are related to the molecular recognition.

(B) Complete the truth table shown bellow

$Ba^{2+}$	$NCS^-$	Output
0	0	
0	1	
1	0	
1	1	

(C) Explain what type of logic gate this is?

(ii) How do you synthesis  $\text{Sm}(\text{cp}^*)_2(\text{thf})_2$ ? Write down the product of the reaction between dinitrogen and  $\text{Sm}(\text{cp}^*)_2(\text{thf})_2$ .  $(2+2+2)+(2+2) = 10$

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