

Register No.: ..... Name: .....

## SAINTGITS COLLEGE OF ENGINEERING(AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER B. TECH DEGREE EXAMINATION (Special), AUGUST 2021

Course Code: 20CYT100

Course Name: Engineering Chemistry

Max. Marks: 100

Duration: 3 Hours

### PART A

*(Answer all questions. Each question carries 3 marks)*

- |                                                                                                                                                                                                                                    | <b>CO</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1. Draw a neat labelled diagram of calomel electrode and write its electrode representation.                                                                                                                                       | [1]       |
| 2. What is cell constant? The specific conductivity of 0.3N KCl solution at 27°C is 0.0002765 ohm <sup>-1</sup> cm <sup>-1</sup> . If the resistance of the cell containing this solution is 500 ohm, calculate the cell constant. | [1]       |
| 3. Which of the following molecules can give IR absorption? Give reason.<br>a) HCl b) O <sub>2</sub> c) HBr d) N <sub>2</sub>                                                                                                      | [2]       |
| 4. Predict the number of proton NMR signals for the following compounds<br>a) H <sub>2</sub> b) CH <sub>4</sub> c) C <sub>6</sub> H <sub>6</sub>                                                                                   | [2]       |
| 5. Mention any three visualization techniques used in TLC.                                                                                                                                                                         | [3]       |
| 6. How nanomaterials are classified based on their dimension?                                                                                                                                                                      | [3]       |
| 7. What are the rules for assigning R & S notation?                                                                                                                                                                                | [4]       |
| 8. What is Kevlar? Write its any two applications.                                                                                                                                                                                 | [4]       |
| 9. What is reverse osmosis?                                                                                                                                                                                                        | [5]       |
| 10. A sample of water contains 162mg/L of Ca(HCO <sub>3</sub> ) <sub>2</sub> , 68 mg/L of CaSO <sub>4</sub> and 95 mg/L of MgCl <sub>2</sub> . Find carbonate and non-carbonate hardness of the water sample.                      | [5]       |

### PART B

*(Answer one full question from each module, each question carries 14 marks)*

#### MODULE I

- |                                                                                                                                                                                                           | <b>CO</b> | <b>Marks</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
| 11. a) Derive Nernst equation for single electrode potential. Write the Nernst equation for Daniel cell. Calculate the equilibrium constant of Daniel cell reaction, given that E <sup>0</sup> cell=1.1V. | [1]       | (10)         |

- b) Write the charging and discharging reactions of Li-ion cell. [1] (4)
- OR**
- |     |                                                                                                                                                                                                                                                                                                                   | <b>CO</b> | <b>Marks</b> |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
| 12. | a) What is electroless plating? How electroless plating of copper and nickel are carried out?                                                                                                                                                                                                                     | [1]       | (10)         |
|     | b) Write the cell reactions and cell representation of Cu-Ag cell.<br>Given that $E^0 \text{Ag}^+/\text{Ag} = +0.80\text{V}$ and $E^0 \text{Cu}^{2+}/\text{Cu} = +0.34 \text{V}$ .<br>Calculate the emf of the cell at $25^\circ\text{C}$ when $[\text{Ag}^+] = 0.1\text{M}$ and $[\text{Cu}^{2+}] = 0.1\text{M}$ | [1]       | (4)          |

### MODULE II

- |     |                                                                                                                                                                                                                                                                        | <b>CO</b> | <b>Marks</b> |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
| 13. | a) Explain the various electronic transitions possible in a molecule. List all the electronic transitions possible in $\text{CH}_4$ and $\text{HCHO}$ .                                                                                                                | [2]       | (10)         |
|     | b) The CO molecule absorbs IR frequency of $2140 \text{ cm}^{-1}$ . Calculate the force constant of the chemical bond. Given that atomic masses of $\text{C} = 12 \text{ amu}$ and $\text{O} = 16 \text{ amu}$ . ( $1 \text{ amu} = 1.67 \times 10^{-27} \text{ kg}$ ) | [2]       | (4)          |

### OR

- |     |                                                                                                                                                                                                                       | <b>CO</b> | <b>Marks</b> |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
| 14. | a) What is chemical shift? What are the factors that affect chemical shift? Predict the number of signals and splitting pattern of $^1\text{H}$ NMR spectrum of $\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$ . | [2]       | (10)         |
|     | b) A solution shows a transmittance of 30% when taken in a cell of 4 cm thickness. Calculate the concentration of the solution if the molar absorption coefficient is $3000 \text{ Lmol}^{-1}\text{cm}^{-1}$ .        | [2]       | (4)          |

### MODULE III

- |     |                                                              | <b>CO</b> | <b>Marks</b> |
|-----|--------------------------------------------------------------|-----------|--------------|
| 15. | a) Compare the principle and instrumentation of TGA and DTA. | [3]       | (10)         |
|     | b) Define the terms a) retention time b) retention factor.   | [3]       | (4)          |

### OR

- |     |                                                                                                                                                      | <b>CO</b> | <b>Marks</b> |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
| 16. | a) Describe the principle, instrumentation and applications of chromatographic technique for the separation of non-volatile components in a mixture. | [3]       | (10)         |
|     | b) Discuss any one method for the preparation of nanomaterials.                                                                                      | [3]       | (4)          |

### MODULE IV

		<b>CO</b>	<b>Marks</b>
17.	a) What is conformational analysis? Draw cis and trans isomers of 1,2-dimethyl cyclohexane. Which conformer is more stable in each case?	[4]	(10)
	b) What is OLED? Write its two advantages.	[4]	(4)

**OR**

		<b>CO</b>	<b>Marks</b>
18.	a) What are conducting polymers? Write the preparation, any two properties and applications of polyaniline.	[4]	(10)
	b) Define with example	[4]	(4)
	a) keto-enol tautomerism    b) enantiomers		

**MODULE V**

		<b>CO</b>	<b>Marks</b>
19.	a) Discuss the theory and procedure of EDTA method for estimation of hardness of water.	[5]	(10)
	b) 50 ml of a water sample requires 22 ml of an EDTA solution for the titration. 20 ml of the same EDTA solution was required for the titration of 50 ml of standard hard water containing 1gm of CaCO <sub>3</sub> per litre. Calculate the hardness of water sample in ppm.	[5]	(4)

**OR**

		<b>CO</b>	<b>Marks</b>
20.	a) Briefly discuss the steps involved in sewage treatment. Describe UASB process.	[5]	(10)
	b) Explain break point chlorination with a neat labelled sketch.	[5]	(4)

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