

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017**

**Course Code: CY100**

**Course Name: ENGINEERING CHEMISTRY**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each question carries 2 marks*

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|---|---|---|
| 1 | Calculate the fundamental vibrational frequency HCl molecule, if the value of force constant of the molecule is $483 \text{ Nm}^{-1}$ . The atomic masses are $^1\text{H} = 1.673 \times 10^{-27} \text{ kg}$ and $^{35}\text{Cl} = 58.06 \times 10^{-27} \text{ kg}$ . | 2 |
| 2 | Represent electrode reactions at different electrodes of a Li <sup>-</sup> ion cell during discharging.   | 2 |
| 3 | Distinguish between retention factor and retention time in chromatography   | 2 |
| 4 | What is ABS? How is it prepared?  | 2 |
| 5 | Define a) Octane number and b) Cetane number.   | 2 |
| 6 | Calculate the theoretical GCV of a petroleum fuel with composition C= 84%, H= 15% , O= 0.4%, N= 0.3% and S=0.3%   | 2 |
| 7 | Give the principle of reverse osmosis?  | 2 |
| 8 | Calculate the BOD of a water sample containing 75 mg of carbohydrate (CH <sub>2</sub> O) per litre.   | 2 |

**PART B**

*Answer all questions, each question carries 3 marks*

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|----|--|---|
| 9  | State and explain Beer- Lamberts law. Mention any two limitations of the law.  | 3 |
| 10 | A zinc rod is dipped 0.3 M CuSO <sub>4</sub> solution. Displacement reactions take place and allowed to attain equilibrium. Find the equilibrium constant of the reaction. [Given that $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$ and $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$ .               | 3 |
| 11 | Explain the visualisation techniques in TLC.   | 3 |
| 12 | Explain the synthesis and applications of polypyrrole.   | 3 |
| 13 | On burning 0.75g of fuel in a bomb calorimeter, the temperature of 2000g of water increases from 27.0 °C to 29.8 °C. The water equivalent of calorimeter and latent heat of steam are 385.0g and 587.0 cal/g respectively. If the fuel contains 0.9% hydrogen, calculate its gross and net calorific values. | 3 |
| 14 | Write a short note on biodiesel.   | 3 |
| 15 | Illustrate break point chlorination with the help of suitable graph. Give any two advantages of break point chlorination.  | 3 |
| 16 | Briefly explain the UASB process for sewage water treatment.   | 3 |

**PART C**

*Each question carries 10 marks.*

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|----|--|---|
| 17 | a) Outline the principles of IR spectroscopy.                                  | 5 |
|    | b) How will you distinguish ethanol and dimethyl ether using NMR spectroscopy? | 5 |

**B**

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OR

- 18 a) Define chemical shift in NMR spectroscopy. Also explain the factors influencing chemical shift. 5  
b) Discuss the possible electronic transitions in acetaldehyde. 5
- 19 a) Outline the setting up of a calomel electrode with a neat diagram. 5  
b) How will you employ the calomel electrode for the determination of electrode potential of copper and zinc? 5
- OR
- 20 a) Explain the working and electrode reactions in H<sub>2</sub>-O<sub>2</sub> fuel cells. 5  
b) Give the procedure for potentiometric estimation of an alkali using a standard acid. 5
- 21 Explain the principles, instrumentation, working and applications of TGA. 10
- OR
- 22 Explain the principles, instrumentation, working and applications of HPLC. 10
- 23 a) Briefly outline chemical synthesis of nanoparticles. 5  
b) What are conducting polymers? Briefly explain their classification. 5
- OR
- 24 a) Discuss the classification of nanomaterials. 5  
b) Outline the preparation, properties and application of silicone rubbers. 5
- 25 Discuss the determination of calorific value of a fuel using a bomb calorimeter. 10
- OR
- 26 a) What are lubricants? How are they classified? 5  
b) Briefly outline following properties of lubricants a) viscosity index b) flash and fire points. 5
- 27 Describe the EDTA method for determination of Hardness of water. 10
- OR
- 28 a) What is meant by COD? How it is determined? Explain its significance in sewage treatment. 5  
b) A sample of water on analysis gave the following results: Ca<sup>2+</sup> = 200 mg/L, Mg<sup>2+</sup> = 180 mg/L, HCO<sub>3</sub><sup>-</sup> = 360 mg/L, Na<sup>+</sup> = 80 mg/L and Cl<sup>-</sup> = 200 mg/L. Calculate the temporary, permanent and total hardness of the sample. 5

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