

Reg No.: _____

Name: _____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019**

Course Code: CH208

Course Name: CHEMISTRY FOR PROCESS ENGINEERING II (CH)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two questions. Each question carries 15 marks.

- 1 a) Describe the theory and instrumentation behind the potentiometric estimation of Fe^{2+} using standard Ce^{4+} solution 6
- b) Anodic stripping voltammetry is a sensitive analytical technique. Justify the statement by explaining the principle and applications. 4
- c) Draw a labelled schematic diagram of mass spectrometer and explain its working 5
- 2 a) Compare the theory and working principle of X-ray photon electron spectroscopy and Auger electron spectroscopy. 7
- b) What are the two types of imaging modes in SEM analysis? How they are obtained? 3
- c) Explain the Amperometric titration of lead ions using standard i) sulphate solution and ii) dichromate solution 5
- 3 a) Calculate the amount of copper deposited at cathode during the electrolysis of 1M CuSO_4 solution through which 10A current passed for 600s. (atomic mass of Cu= 63.5) 3
- b) Give the principle and any two applications of polarographic analysis 5
- c) How atomic emission spectroscopy is useful in estimating the trace amount of elements? Explain with a schematic diagram of the spectrometer. 7

PART B

Answer any two questions. Each question carries 15 marks

- 4 a) What is critical solution temperature? Draw the phase diagram of water-nicotine system and mark CST 4
- b) Derive Nernst distribution law from thermodynamic considerations 6
- c) State and explain Kohlrausch's law. Calculate λ_m^∞ of NH_4OH . Given that λ_m^∞ of NH_4Cl , NaOH and NaCl are 129.8, 218.4 and 108.9 $\text{Scm}^2 \text{mol}^{-1}$ respectively. 5

- 5 a) Explain the principle and applications of solvent extraction. 5
- b) Explain Debye Huckel theory of strong electrolytes. Write DHO equation and describe the variation of molar conductance with concentration. 5
- c) Give the working principles of i) urea biosensor and ii) glucose biosensor 5
- 6 a) Derive the Nernst equation for the concentration cell $Zn/Zn^{2+}(C_1)// Zn^{2+}(C_2)/Zn$. Calculate the EMF of this cell if $E_{Zn^{2+}/Zn}^0 = -0.76V$, $C_1=0.01M$, $C_2= 0.1M$ 4
- b) Define the term transport number of an ion. How it is related to the ionic mobility? 3
- c) Explain the principles and applications of i) Park's process and ii) steam distillation 8

PART C

Answer any two questions. Each question carries 20 marks.

- 7 a) Derive Gibbs adsorption isotherm and explain the term surface excess 10
- b) Calculate the half life of a radioactive element if the 30% the substance decayed after a period of 250 min. 5
- c) Illustrate nuclear fission with an example. How can we explain the mechanism of fission using liquid drop model? 5
- 8 a) Derive Langmuir adsorption isotherm. 6
- b) State and explain i) Hardy Schultz rule and ii) Gold number 4
- c) Explain the principles and applications of i) neutron activation analysis and ii) radio dating techniques 10
- 9 a) How the surface area of the adsorbent is calculated using BET equation? 5
- b) Define the term emulsion. Give the classification and any four applications of emulsions 5
- c) Explain the term binding energy of nucleus? How will you relate the binding energy with the stability of nucleus? 4
- d) Differentiate between transient and secular equilibria with proper equations 6