Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019
Course Code: CH208
Course Name: CHEMISTRY FOR PROCESS ENGINEERING II

Max. Marks: 100 Duration: 3 Hours

PART A
Answer any two questions. Each question carries 15 marks.

1 a) What is the principle of potentiometric titration, how can it be used for the determination of end point of a titration between HCl and NaOH. 7

   b) What is atomization in atomic absorption spectroscopy? How electrothermal atomizers are different from flame atomizers? 4

   c) Compare the principle of XPS and Auger Spectroscopy 4

2 a) What is the principle of anodic stripping voltammetry? Explain various steps involved in it? 4

   b) Differentiate between anodic and cathodic polarographic waves. 3

   c) Explain the working of mass spectrometer with diagram. Give any one drawback of this technique. 8

3 a) Write short note on residual and limiting current in polorography with the help of a neat diagram. 4

   b) What is the principle behind amperometric titration? Sketch the titration curve that could be expected in an amperometric titarion of Ni^{2+} against trimethyl glyoxime at an applied potential of -1.85V with a DME (reduction potential of trimethyl glyoxime under the same conditions is -1.85V). Comment on the nature of the plot. 4

   c) Explain the principle and instrumentation of scanning electron microscopy. 7

PART B
Answer any two questions. Each question carries 15 marks

4 a) Derive an equation for the determination of transport number using Hittorff's method. 7

   b) How the vapour pressure properties of two immiscible liquids are made use in steam distillation 5

   c) Explain the temperature-composition diagram of nicotine-water system. 3

5 a) How Nernst distribution law is modified in the case of association of solute in one of the solvents 4

   b) Explain asymmetry effect and electrophoretic effect. 4

    c)   An aqueous solution of succinic acid at $45^{\circ}C$ containing 0.07 g in 10 ml is in   4
        equilibrium with an ethereal solution which has 0.013 g in 10 ml. The acid has its
        normal molecular weight in both the solvents. What is the concentration of the
        ethereal solution which is in equilibrium with an aqueous solution containing 0.024
        g in 10 ml.

    d)   Explain the working principles of CO_2 and urea sensors   3

6 a) State Distribution law. Deduce the formulae for distribution if the solute enters in to   7
        chemical combination with one of the solvents.

    b) What is electrochromism? Explain the working of electrochromic devices.   4

    c) State Kohlrausch's law. How this law can used for the determination of molar   4
        conductance of a weak electrolyte?

PART C
Answer any two questions. Each question carries 20 marks.

7 a) What is adsorption isotherm? Explain the effect of pressure and temperature on   5
        adsorption

    b) Explain transient and secular equilibrium of nuclear decay with appropriate   6
        expressions.

    c) Explain Donnan membrane equilibrium   5

    d) $_{27}Co^{60}$ decays with a half-life of 5.27 years to produce $_{28}Ni^{60}$.   4

        i)   What is the decay constant for the radioactive disintegration of cobalt-
              60?

        ii)   How long does it take for a sample of $_{27}Co^{60}$ to disintegrate to the extent
              that only 2.0% of the original amount remains?

8 a) Balance the following nuclear reactions and find "X"   3

        i) $_7N^{14} + n \rightarrow X + \alpha$

        ii) $_{79}Au^{197} + n \rightarrow X + \gamma$

        iii) $_{92}U^{238} \rightarrow X + 8\,\alpha + 6\,\beta$

    b) What are surfactants? Discuss about their classification with suitable examples.   8

    c) What is liquid drop model of nucleus? How can this be used to explain nuclear   7
        fission?

    d) Define gold number.   2

9 a) Derive Gibbs adsorption isotherm. Give an expression for Gibbs surface excess.   8

    b) Compare any two properties of true solutions and colloidal solutions?   2

    c) What is nuclear cross section? How is it related to the rate of a nuclear reaction?   3

Give an expression for it.

d) What is the principle involved in neutron activation analysis? Describe any three   7
applications of NAA.