PG Odd Semester (CBCS) Exam., December—2016

CHEMISTRY

(1st Semester)

Course No. : CHMCC–104

(Physical Chemistry—II)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. *(a)* Clearly stating the assumptions and approximations involved, give a concise account of the Debye-Hückel theory of electrolytic solution. 12

   (b) Define the electrochemical potential of an ion. 2

2. *(a)* Discuss the principle of determination of pH of a solution using calomel electrode. 4

   (b) Discuss the Born model for the calculation of free energy for the 'ion-solvent' interaction mentioning the assumptions. 10

(2)

UNIT—II

3. *(a)* How do you explain the term 'corrosion' in terms of oxidation and reduction? Illustrate the process of corrosion with an example and techniques available for protection. 7

   (b) With a suitable diagram, explain the terms 'outer potential', 'inner potential' and 'volta potential'. 3

   (c) The exchange current density of H , H_2/Pt is 0 79 mA cm ^{2}. What current does flow through a standard electrode of total area 5 0 cm^2 when the over-potential is 5 0 mV? 4

4. Define electric double layer. Give a brief schematic presentation of the Helmholtz-Perrin model and Gouy-Chapman model of electrode-solution interface and discuss their limitations.

   $2+5+5+2=14$

UNIT—III

5. *(a)* Explain the formation of $MgAl_2O_4$ in terms of Kirkendall effect and Wagner reaction mechanisms. 6

   (b) "Alkali metal halide when heated in the presence of alkyl metal vapour shows colour." Explain. 3

(c) By considering band theory, explain electronic structure of conducting solids and intrinsic semiconductor. 5

6. *(a)* Discuss the factors influencing the rate of solid-state reaction. 6

(b) Discuss the types of solid solution by taking an example. 5

(c) Explain the non-stoichiometric defects with examples. 3

UNIT—IV

7. *(a)* What is Gibbs dividing plane? Obtain an expression relating pressure across a surface to the curvature of the surface.

1+5=6

(b) With the help of orbital energy level diagram, distinguish among three basic processes of photoelectron spectroscopy. 5

(c) The surface tension of ethanol-water mixture follows the equation

$$(10^{-3} \text{ Nm}^{-1}) \quad 72 \cdot 0 - 0 \cdot 5 \, (c/\text{mol dm}^{-3})$$
$$+ 0 \cdot 2 \, (c/\text{mol dm}^{-3})^2$$

where c is the molar concentration of ethanol and the temperature is 298 K. Calculate the surface excess of ethanol for a $0 \cdot 5$ mol dm^{-3} solution. 3

8. *(a)* Derive an expression for multilayer adsorption isotherm. 6

(b) Explain how BET adsorption isotherm is used to estimate the surface area of a solid. 3

(c) Obtain an expression relating to surface excess concentration of solute with surface tension and discuss its consequences with surface active and surface inactive agents. 5

UNIT—V

9. *(a)* Mention and explain five important factors which affect the cmc of a surfactant and micellar size in aqueous solutions. 5

(b) Explain the effect of temperature and pressure on critical micelle concentration and solubility. 4

(c) Write a short note on the kinetic of micelle formation. 5

10. *(a)* Write a short note on the thermodynamic of micelle formation considering both *(i)* phase separation model and *(ii)* mass action model. 8

(b) Write short notes on : 2+2+2=6

   (i) Micellization

   (ii) Microemulsion

   (iii) Reverse micelle

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