MANIPAL UNIVERSITY

Reg. No.										

Deemed- to -be -University under Section 3 of the UGC Act, 1956

DEPARTMENT OF SCIENCES, II SEMESTER M.Sc (CHEMISTRY)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017

PHYSICAL CHEMISTRY II [CHM 606]

(REVISED CREDIT SYSTEM)

Time: 3 Hours Date: 25-4-2017 MAX. MARKS: 50

Note: (i) Answer any **FIVE FULL** questions
(ii) Draw diagrams, and write equations wherever necessary

1. **(a)** Prove that principles of quantum mechanics are applicable only to micro particles.

   (b) Show why it is not possible to plate zinc on to platinum by electrolysis of a zinc salt at unit activity in neutral solution at a current density of 1 $mAcm^{-2}$. Given the tafel constants for the deposition of zinc on platinum are a = 0.280 V and b = 0.059 V respectively,.

   (c) Derive time independent Schrödinger wave equation

   [2 + 2+ 6]

2. **(a)** Justify the following statement: Large excess of potential required for constant current Coulometric method.

   (b) (i)The speed of a 1 gm projectile is known to be within $1x10^{-6}$ ms^{-1}. Calculate the minimum uncertainty in its position. (Given: h = $6.626 x10^{-34}$ J s.)

   ii) What is the wavelength of the light absorbed when an electron in a linear molecule $10A^{o}$ long makes a transition from the energy level, n=1 to the level n=2 (mass of electron= $9.109 x10^{-31}$ kg)

   (c) Set up Schrodinger wave equation for particle rotating in a sphere, separate the variables and solve for theta 'Θ' equation.

   [2 + 2+ 6]

3. **(a)** Justify the following statement with an example: All quantum mechanical operators need not commute with one another.

(b) Which of the functions sin 3x and $5x^3$, are Eigen functions of d^2/dx^2? For the Eigen function state the Eigen value.

(c) Derive the Butler-Volmer equation for a single step one electron transfer electrode reaction

[2 + 2+ 6]

4. **(a)** Justify the following statement: Solution of a particle in a box model is useful in calculation of bond length of conjugated dienes.

(b) A concentration cell was constructed by immersing two silver electrodes in 0.05M and 0.1M $AgNO_3$ solution. Write cell representation, cell reactions and calculate the EMF of the concentration cell.

(c) Elucidate the structure of 1,3 butadiene using Huckel molecular orbital theory and give the graphical representation of Huckel molecular orbitals

[2 + 2+ 6]

5. **(a)** Justify the following statement: Equilibrium electro-analytical techniques deal with the systems where no current is drawn from or fed into.

(b) Calculate the wavelength of an electron ($m= 9.109 \times 10^{-31}$ kg) having potential energy equal to 1000 eV. Express your answer in S.I Unit.

(c) Transform Schrödinger wave equation from cartesian co-ordinates (X,Y) to polar coordinates.

[2 + 2+ 6]

6. **(a)** Calculate the electron density of bonding and antibonding molecular orbitals of molecular hydrogen ion. Sketch the energy levels of the molecular orbitals

(b) (i) What is corrosion? Describe the mixed potential theory, with the help of a plot, explain the determination of E_{corr} and i_{corr} value of any metal.

(ii) Explain and write the significance of the following:

(a) Exchange current density **(b)** Polarisation

[4+ 6]

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