

M.Sc. Examination, 2017

Semester-IV

Chemistry (Elective)

Course: CH-1021

(Physical Chemistry)

Time: Three Hours

Full Marks: 40

Questions are of value as indicated in the margin.

Answer *any four* questions.

1. a) Using Fourier transform solve the Einstein's diffusion equation. Your calculation may imply that Fourier transform of a Gaussian function is also a Gaussian function. Prove that their widths are not independent of each other. Is it consistent with the Dirac δ -function? 3+2+1
b) How de Broglie realized that the connection between the wave-particle dualities may be related by $p = \frac{h}{\lambda}$ for a free particle? Is this relation true for relativistic free particle? 3+1
 2. Derive the Fokker-Planck equation in velocity space for a free Brownian particle. How this law of causality changes if there is a force field, $K(x) = -V'(x)$. (Symbols have usual meaning). 6+4
 3. a) When an electrodic reaction across interfaces exhibits Ohmic behavior? 2
b) How it is possible to measure the overpotential when the absolute value of potential difference across an interface can't be measured? 2
c) Show that a corroding metal is analogous to a short circuited energy producing cell. 2.5
d) Define the corrosion current and corrosion potential by the help of Evans diagram. 1.5
e) In which step of corrosion process corrosion current is controlled? 2
 4. Give a brief overview of metal/solution interface. Discuss the salient features of semiconductor/solution interface. In this context make a comparative study of metal/solution and metal/semiconductor interfaces. 3+4+3
 5. Show that for minimum entropy production, σ -must decrease with time. Justify the statement – "Steady state is fed with negative entropy". Show that forbidden coupling is possible in order to attain steady state. 4+3+3
 6. What do you mean by carrier mediated transport (CMT)? Show that in CMT, at any point inside the membrane, the sum of concentrations of carrier and the complex is constant. Also show that CMT reaches a limiting value for very high initial concentration of the species transported. Mention all the necessary assumptions. 2+4+4
-