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Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Physical and Chemical Principles of Nano Technology

Max. Marks:100

Time: 3 hrs.

**Note: 1. Answer any FIVE full questions, selecting
atleast TWO questions from each part.
2. Error function table can be referred.**

PART - A

- 1 a. Explain lattice waves in linear mono atomic lattice by deriving the dispersion relation. Also draw dispersion curve. (09 Marks)
- b. Explain Einstein's model for molar heat capacity. Write its limitations. (08 Marks)
- c. Calculate the highest possible frequency for copper if its Dabye temperature is 350K. Given Boltzmen constant $= 1.38 \times 10^{-23} \text{ JK}^{-1}$; Planck's constant $= 6.626 \times 10^{-34} \text{ JS}$. (03 Marks)
- 2 a. Discuss Kronig – Penney model. On the basis of this, explain Brillouin zones. (15 Marks)
- b. Explain Haff effect. (05 Marks)
- 3 a. Show that Fermi level is located exactly half way between valance band and conduction band in the case of intrinsic semi conductor. Hence derive the expression for conductivity of it. (15 Marks)
- b. Explain rectifier action of P – n junction. (05 Marks)
- 4 a. State and explain first and second law of thermo dynamics. (12 Marks)
- b. State and prove Clausius theorem. (08 Marks)

PART - B

- 5 a. State and prove Liouville's theorem. (08 Marks)
- b. Explain Fermi – Dirac statistic and write one application. (05 Marks)
- c. Explain Gibb's free energy and write Gibb's paradox. (07 Marks)
- 6 a. Thermodynamically derive the entropy of mixing in solution. (07 Marks)
- b. Explain mean ionic activity coefficients. (08 Marks)
- c. 1.2g of a non – volatile substance was dissolved in 100g of acetone at 22°C. The vapour pressure of the solution was found to be 183mm of Hg. Calculate the molecular weight of substance. Vapour pressure of acetone = 185 mm of Hg at 22°C. (05 Marks)
- 7 a. Explain Fick's second law and obtain the solution. (12 Marks)
- b. A 20mm thick duration sheets are covered on either side with 0.2mm thick aluminum sheets. For retaining the corrosion resistance, the copper concentration at a depth of 0.1mm from the outer surface should not exceed 0.4%. How long can the material be kept at 550°C, without damaging the corrosion resistance. Given : D_o for C_u in Al is $0.25 \times 10^{-4} \text{ m}^2 \text{ s}^{-1}$, $Q = 121 \text{ KJ / mol}$, $R = 8.314$. For $Du - Al$ interface $(x, o) = 4\%$. (08 Marks)
- 8 a. Explain five factors responsible for self assembly. (10 Marks)
- b. Explain Self Assembled Monolayer (SAM). Describe any 4 SAM production methods. (10 Marks)