NATIONAL INSTITUTE OF TECHNOLOGY PATNA MID SEMESTER EXAMINATION, March 2024

Program: DD-M.S.E

Semester: 4

Department: Physics

Course Code: PH48103

Course Name: Introduction to Bioscience and

Technology

Full Marks: 30

Duration of Examination: 2 Hours

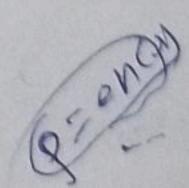
Answer all questions.

Discuss the notions of discrete and continuous distributions. Explain in detail the significance of mean and variance. Consider the distribution function P(x), evaluate the variance where,

$$P(x) = \begin{cases} \frac{1}{a}, & 0 \le x < a \\ 0, & otherwise \end{cases}$$

Explain in detail why the Poisson-Boltzmann theory is called the theory of length scales. Write a note on activation energy in a two-state model.

[15]



NATIONAL INSTITUTE OF TECHNOLOGY, PATNA MID SEMESTER EXAMINATION- March 2024

Department: Physics Semester: 4 Program: BT-MT (DD-PH-MSE) Course Name: Phase diagrams & transformations Course Code: PH48101 **Duration of Examination:** 2 hours Full Marks: 30 Attempt all questions. Please assume missing data suitably, if any. (a) Briefly explain equilibrium and non-equilibrium cooling with development of Q.1. microstructure in the copper-nickel phase diagram. (b) A copper-nickel alloy of composition 60 wt% Ni-40 wt% Cu is slowly heated from a temperature of 1300 °C. (i) At what temperature does the first liquid phase form? (ii) What is the composition of this liquid phase? (iii) At what temperature does complete melting of the alloy occur? (iv) What is the composition of the last solid remaining prior to complete melting? (a) Derive the Lever rule and explain in detail. (b) Describe briefly Gibb's Phase rule with suitable example. (c) Describe briefly lead-tin phase diagram. Calculate the relative amount of each phase present in terms of mass and volume fractions. At 150°C, take the densities of lead and tin to be 11.23 and 7.24 g/cm³, respectively. Q.3. (a) Define solubility limit and discuss Hume-Rothery criteria for solid solution. (b) Define the terms eutectic, eutectoid and peritectic reactions by taking suitable examples. (c) Discuss time-temperature transformation (TTT) diagram with suitable example.

National Institute of Technology Patna

Department of Mathematics

Mid Semester Examination : March 2024 MA48101: Numerical Methods for Engineers

Maximum Marks: |30|

Time: 02.00 hours

Branch: B. Tech + M.Tech (Dual Degree) Semester: 4th

Answer Any Six Questions

- 1. Show all the steps involved in the computation.
 - (a) Using 5-digit rounding, compute 42500 + 25.874 37679.
 - (b) Let a = 0.00656, b = 0.133, c = 0.129. Using 3-digit rounding, compute (a + b) + c, and a + (b + c).
- 2. Instead of using the true values $x_T = 0.71456371$ and $y_T = 0.71456238$ in calculating $z_T = x_T$ $y_T = 0.133 \times 10^{-5}$, if we use the approximate values $x_A = 0.71456414$ and $y_A = 0.71456103$, and calculate $z_A = x_A - y_A (= 0.311 \times^{-5})$, then find the loss of significant digits in the process of calculating z_A when compared to the significant digits in x_A .
 - 3/Find the condition number at a point x = c for the following functions

(a)
$$f(x) = a^x$$

(b)
$$f(x) = 1 + x + x^2$$
.

Use the Doolittle's factorization to solve the system

$$4x_1 + x_2 + x_3 = 4$$

$$x_1 + 4x_2 - 2x_3 = 4$$

$$3x_1 + 2x_2 - 4x_3 = 6.$$

5. Consider the matrix $A = \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$. Find the norm of A_{∞} , A_2 and A_1 . Also verify that $||Ax|| \le ||A|| ||x||$ for the any of the two norm defined above (The vector norm is understood in the sense that the matrix norm is subservient to it.).

6. Solve the system
$$Ax = b$$
 by Gauss-Jacobi method with $A = \begin{bmatrix} 10 & 3 & 1 \\ 2 & -10 & 3 \\ 3 & 3 & 10 \end{bmatrix}$, $b = \begin{bmatrix} 14 \\ -5 \\ 14 \end{bmatrix}$, and

$$x^{(0)} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$
. Tabulate the results upto first 5 iteration.

7. Find the minimum number iterations needed to approximate the root of the equation e^x – $3x^2 = 0$ in (3,4) such that the absolute error is less than or equal to 10^{-3} . Also find the corresponding approximate solution.

eh-31/20

9x4+3/+2=9 (X) = A'IIAIL KCA) = A'IIAIL 3-20