Basic Mathmatics-I

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech-I Semester (BT/BI)

COURSE CODE (CREDITS): 25B11MA112 (4) MAX. MARKS: 35

COURSE NAME: MATHEMATICS FOR LIFE SCIENCES-I

COURSE INSTRUCTORS: P K PANDEY MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

(c) Use of calculator is permitted.

Q.No.	Question	CO	Marks
Q1	Suppose a diagnostic system records three vital signs (heart rate, systolic pressure, oxygen saturation) in three patients given by matrix: $A = \begin{bmatrix} 80 & 120 & 100 \\ 72 & 108 & 96 \\ 64 & 96 & 92 \end{bmatrix}$ Using the row echelon form, find the rank of above matrix.	CO1	5
Q2	A drug concentration over time t (in hours) is given by $f(t) = \frac{100}{(t+5)}$ mg/litre. Compute the rate of change at $t = 2$ hour. *Hint:* $\frac{df}{dt}$ *at* $t = 2$.	CO-2	5
Q3	Suppose a drug concentration in the bloodstream is modeled by $f(t) = 8e^{-0.3t}$ mg/litre. Using the Taylor series expansion (up to first three terms) at $t = 0$, approximate $f(1)$.	CO-2	5
Q4	Suppose two biochemical pathways are represented by vectors (of effect strengths), say, pathway vector $\vec{p} = 6i + 8j + 4k$ and the drug action vector $\vec{d} = 3i + 1j + 2k$. Compute the projection of drug effect onto the pathway, i.e., $Proj_{\vec{p}}\vec{d}$.	CO-3	5
Q5	Suppose a model describing hormone release cycles leads to equation $z^3 - 27 = 0$. Using the DeMoivre's theorem, solve this equation.	CO-4	5
Q6	Suppose a drug in the bloodstream is eliminated by (body organs e.g., liver, kidney etc.), and the instantaneous elimination rate at time t hours is given by $r(t) = \frac{6}{(t+1)(t+2)}$ mg/hour. Compute the amount of total drug eliminated between $t = 0$ to $t = 3$ hours.	CO-5	5
Q7	Suppose the Oxygen consumption rate of a tissue is given by $f(t) = 4 + 0.5\sin\left(\frac{\pi t}{5}\right)$ ml/minute. Compute the total Oxygen consumed between $t = 0$ to $t = 10$ minutes.	CO-5	5

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