National Centre for Nanosciences and Nanotechnology
M.Sc. Sem I Examination
Paper III: Essential Mathematics PSNN103

Sample Multiple Choice Questions

1. Let V be a vector space with dimension 12. Let S be a subset of V which is linearly independent and has 11 vectors. Which of the following is FALSE?
   a. There must exist a linearly independent subset S_1 of V such that $S \nsubseteq S_1$ and S_1 is not a basis for V.
   b. Every nonempty subset S_1 of S is linearly independent.
   c. There must exist a linearly dependent subset S_1 of V such that $S \nsubseteq S_1$.
   d. Dimension of span $(S) <$ dimension of V.

2. Let A be a 5X5 matrix with al real elements and let $x \neq 0$. Then $x, Ax, A^2 x, A^3 x, A^4 x, A^5 x$ are
   a. Linearly independent
   b. Linearly dependent
   c. Linearly independent if and only if A is symmetric.
   d. linear dependent / independent: unable to decide due to insufficient information.

3. The necessary condition for the McLaurin expansion to be true for function f(x) is _____.
   a. f(x) should be continuous.
   b. f(x) should be differentiable.
   c. f(x) should exists at every point.
   d. f(x) should be continuous and differentiable

4. The expansion of $e^{Sin(x)}$ is?
   a. $1 + x + {}^{x^2}/_2 + {}^{x^4}/_8 + \ldots$
   b. $1 + x + {}^{x^2}/_2 - {}^{x^4}/_8 + \ldots$
   c. $1 + x - {}^{x^2}/_2 + {}^{x^4}/_8 + \ldots$
   d. $1 + x + {}^{x^3}/_6 - {}^{x^5}/_{10} + \ldots$

5. The inverse of a symmetric matrix (if it exists) is?
   a. symmetric matrix.
   b. A skew symmetric matrix.
   c. A diagonal matrix.
   d. A triangular matrix

6. Find the rank of the matrix $a \begin{bmatrix} 4 & 2 & -1 & 2 \\ 1 & -1 & 2 & 1 \\ 2 & 2 & -2 & 0 \end{bmatrix}$

a. 0
b. 1
c. 2
d. 3

7. If the function f(x) is even, then which of the following is zero?

   a. a_0
   b. a_n
   c. b_n
   d. nothing is zero

8. Next Find the Eigen vector for value of λ=-2 for the given matrix $\begin{bmatrix} 3 & 5 \\ 3 & 1 \end{bmatrix}$

   a. $\begin{bmatrix} 0 \\ -1 \end{bmatrix}$

   b. $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$

   c. $\begin{bmatrix} i \\ -1 \end{bmatrix}$

   d. $\begin{bmatrix} 0 \\ -i \end{bmatrix}$

9. The perpendicular distance from the point (3,−4) to the line $3x^2 - 4x + 10 = 0$

   a. 7
   b. 8
   c. 9
   d. 10

10. Here are two statements about the roots of the equation $x^2 - 8x + 12 = 0$.
    i. The roots are real and rational.
    ii. The roots are equal.

    Which of the following is true?

    a. Neither statement is correct.
    b. Only statement (i.) is correct.
    c. Only statement (ii.) is correct.
    d. Both statements are correct.