FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2024

(FYUGP)

CC24U BCA1 CJ102 - MATHEMATICAL FOUNDATIONS FOR COMPUTER APPLICATIONS

(Computer Application - Major Course)

(2024 Admission - Regular)

Time: 2.0 Hours   Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer **all** questions. Each question carries 3 marks.

1. Define Scalar matrix with an example.   [Level:1] [CO1]

2. Let A and B be two matrices of same order. Then prove that $A + B = B + A$ with examples.   [Level:2] [CO1]

3. Find the dot product and cross product of the vectors $\vec{a} = 3\vec{i} - \vec{j} + 2\vec{k}$ and $\vec{b} = 2\vec{i} + \vec{j} - \vec{k}$.   [Level:2] [CO3]

4. Verify whether the matrix $A = \begin{bmatrix} 0 & 2 & -3 \\ -2 & 0 & 4 \\ 3 & -4 & 0 \end{bmatrix}$ is symmetric or skew-symmetric.   [Level:2] [CO1]

5. If $A = \begin{bmatrix} 1 & 1 \\ 3 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 1 \\ 1 & -1 \end{bmatrix}$, find $(B^T - A^T)^T$.   [Level:2] [CO1]

6. Find (a) $\lim\limits_{t \to -1} \dfrac{t^2 + 2}{t + 4}$ (b) $\lim\limits_{t \to -1} \dfrac{-t^3 + 2t^2 - t + 1}{t^2 + 1}$ [Level:2] [CO4]

7. Use logarithmic differentiation to differentiate the function $y = (x - 7)(x - 2)$.   [Level:3] [CO4]

8. Evaluate the following integral   (a) $\int 8\,dx$.   (b) $\int (x + x^2)\,dx$.   [Level:2] [CO5]

9. Evaluate the following integrals $\int \dfrac{lnx}{x}\,dx$.   [Level:2] [CO5]

10. Evaluate (a) $\int \dfrac{1}{x}\,dx$ (b) $\int \frac{2}{x-1}\,dx$ [Level:2] [CO5]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer **all** questions. Each question carries 6 marks.

11. Find adjoint of the matrix $\begin{bmatrix} 2 & 0 & 3 \\ 0 & 3 & 2 \\ -2 & 0 & -4 \end{bmatrix}$.   [Level:2] [CO1]

12. Apply elementary row transformations for the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 0 & 2 \\ 2 & 1 & -3 \end{bmatrix}$ to reduce to Identity Matrix. [Level:3] [CO1]

13. Find the eigen values of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. [Level:2] [CO2]

14. Show that the matrix $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ satisfies the equation $A^3 - 6A^2 + 7A + 2I = 0$. [Level:2] [CO1]

15. Using first principle of differentiation , evaluate $f'(x)$ for the function $f(x) = x^2$. [Level:3] [CO4]

16. Use Chain Rule to differentiate the following functions [Level:3] [CO4]

(a) $f(x) = \sqrt[3]{x^2 + 4}$.

(b) $f(x) = \left(\frac{2}{3}x^3 + 4x^2 + \sqrt{x} \right)^4$.

17. Evaluate $\int_1^2 2x\sqrt{x^2 - 1}dx$. [Level:2] [CO5]

18. Evaluate the definite integral $\int_2^4 (\frac{1}{2}x^6 - 3x + 2)dx$. [Level:2] [CO5]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any *one* question. The question carries 10 marks.

19. Apply Gauss Elimination method to solve the given system of equations [Level:3] [CO2]
$$x + y + z = 4$$
$$x + 4y + 3z = 8$$
$$x + 6y + 2z = 6.$$

20. (a) Use product rule to differentiate the function $f(x) = (x + \frac{1}{x})(x - \frac{1}{x} + 1)$. [Level:2] [CO4]

(b) Differentiate the function $y = \frac{x^2 - 3x + 4}{x^2 - x}$.

(1 × 10 = 10 Marks)

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