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21BSC1C1MTL(46126)

B.Sc. I Semester Degree Examination, April/May - 2024

MATHEMATICS

DSC-1 : Fundamentals of Algebra and Calculus

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *Answer* ***all*** *the Sections.*

Note : (i) Answer **all** the questions from **Section - A**.
(ii) Answer **any four** questions from **Section - B**.
(iii) Answer **any three** questions from **Section - C**.

SECTION - A

1. Answer the following sub-questions. Each sub-question carries **one** mark. **10x1=10**

(a) Define symmetric matrix.
(b) Define rank of the matrix.
(c) Define consistency and inconsistency of a system of linear equation.
(d) Find the value of λ which the system has non-trivial solution $7x+4y+3z=0$, $x+2y+\lambda z=0$ and $x+3y+2z=0$.
(e) Define pedal equation of a polar curve.
(f) Write the formula for angle between radius vector and tangent.
(g) Evaluate : $\lim_{x\to 0} \frac{1-\cos x}{x\log(1+x)}$
(h) State Cauchy's mean value theorem.
(i) Find the 5^{th} derivative of $y=e^{2x}$.
(j) State Leibnitz theorem for the n^{th} derivative of a product.

SECTION - B

Answer **any four** of the following questions carries **five** marks each. **4x5=20**

2. Using Cayley-Hamilton's theorem find A^{-1} if $A=\begin{bmatrix} 3 & 1 \\ -1 & -2 \end{bmatrix}$.

3. Find the Eigen value and Eigen vector of matrix $A=\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.

4. Show that the curve $r=a^n\cos n\theta$ and $r=b^n\sin n\theta$ intersect orthogonally.

P.T.O.

5. Evaluate : $\lim_{x\to 1}\left[\frac{x}{x-1}-\frac{1}{\log x}\right]$.

6. Verify Roll's theorem for the function $f(x)=x^2-4x+8$ in the interval [1, 3].

7. Find the n^{th} derivative of $y=e^{ax}\sin(ax+b)$.

SECTION - C

Answer **any three** of the following questions, each question carries **ten** marks. **3x10=30**

8. (a) Find the rank of the matrix by reducing into normal form. **6**

$$A=\begin{bmatrix}0 & 1 & -3 & -1\\ 1 & 0 & 1 & 1\\ 3 & 1 & 0 & 2\\ 1 & 1 & -2 & 0\end{bmatrix}$$

(b) If 'A' is a symmetric matrix then show that KA is also symmetric matrix. **4**

9. (a) Test for consistency and solve **5**

$x+y+z=6$
$x-y+2z=5$
$3x+y+z=8$

(b) Find the non-trivial solution of the system **5**

$x+3y-2z=0$
$2x-y+4z=0$
$x-11y+14z=0$

10. (a) Find the Pedal Equation for $r^n=a^n\cos n\theta$. **5**

(b) Derive the formula for Radius of curvature $\int=\frac{\left(1+y_1^2\right)^{3/2}}{y_2}$. **5**

11. (a) Expand $e^{\sin x}$ using Maclaurin's theorem upto the term containing x^4. **5**

(b) Verify the Cauchy's mean value theorem $f(x)=x^2+3$, $g(x)=x^3+1$ in [1, 3]. **5**

12. (a) If $y=a\cos(\log x)+b\sin(\log x)$ show that $x^2y_{n+2}+(2n+1)xy_{n+1}+(n^2+1)y_n=0$. **5**

(b) Find the n^{th} derivative of $\sin x.\sin 2x.\sin 3x$. **5**

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