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 Code No. **5002/N**

**FACULTY OF ENGINEERING AND INFORMATICS**  
**S.E. 1 Year (New) (Common to All Branches) (Suppl.) Examination,**  
**January 2012**  
**MATHEMATICS – I**

Time: 3 Hours]

[Max. Marks: 75]

*Note: Answer all questions from Part A. Answer any five questions from Part B.*

**PART A** (25 Marks)

1. Are these vectors linearly dependent ? Verify.

(4, 2, 1) (2, 3, 2) (1, 1, 4). 3

2. Find the sum of the Eigen values of A 2

$$A = \begin{pmatrix} 2 & 1 & 3 & 2 \\ 5 & 6 & 3 & 2 \\ 3 & 4 & 1 & 2 \\ 1 & 0 & 0 & 2 \end{pmatrix}$$

3. Test for convergence  $\lim_{n \rightarrow \infty} \frac{1}{2n+1}.$

4. Discuss the convergence  $\lim_{n \rightarrow \infty} \frac{n+1}{2n+5}.$  2

5. Expand  $f(x) = \cot x$  about  $x = \frac{\pi}{4}$  3

6. Find the radius of curvature at origin of the curve  $y = x^2 - 2xy + y^2.$  2

7. Determine  $(x,y) \underset{(0,0)}{\overset{\text{urn}}{\rightarrow}} \frac{xy}{x^2 + y^2}$  3

(This paper contains 3 pages)

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8. If  $u = \sin^{-1} \frac{x}{y} + \tan^{-1} \frac{y}{x}$ , show that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0$  2

9. Evaluate :  $\int f(x^2 y) dx dy$  over the first quadrant of  $x^2 + y^2 = 1$ . 3

10. Find the directional derivative of  $f(x, y) = x^3 - y^2$  at  $(1, 1)$  in the direction of  $2i + 3j$ . 2

**PART - B** **(5x10=50 Marks)**

11. a) Using Cayley-Hamilton theorem, find the inverse 5

$$\begin{vmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{vmatrix}$$

b) Reduce the quadratic forms to Canonical forms  $x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ . 5

12. a) Discuss the convergence of  $\sum_{n=1}^{\infty} \frac{n! 2^n}{n^n}$  5

b) Test the series  $\sum_{n=1}^{\infty} \frac{1}{\left(1 + \frac{1}{n}\right)^{n^2}}$  for convergence. 5

13. a) Verify Lagranges Mean Value theorem for  $f(x) = x^3 - 3x - 1$  in  $(-1, 1)$ . 5

b) Find the envelope of the family of straight lines  $x + \frac{y}{a+b} = 1$  where  $a+b=c$ ,  $c$  is constant. 5

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 14. a) Find the radius of curvature  $y^2 = 4ax$  at  $(at, 2at)$ . 5

 b) Find local maxima and minima of  $f(x) = 3x^4 - 2x^3 - 6x^2 + 6x + 1$ . 5

 15. a) Find the area of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  using Green's theorem. 5

 b) If  $\mathbf{A}$  is a constant vector and  $\mathbf{R} = i +$  show that

$$\nabla \times (\mathbf{A} \times \mathbf{A}) = \mathbf{A} \times \nabla \times \mathbf{A} \quad 5$$

16. a) Reduce the matrix to normal form and find rank. 5

$$\begin{vmatrix} -3 & -6 & 1 & 2 \\ 1 & 2 & -3 & 3 \\ 1 & 2 & 1 & 1 \end{vmatrix}$$

 b) Discuss the convergence of the series  $\sum_{n=1}^{\infty} \frac{n+1)^3}{n^n} x^n, x > 0$ . 5

 17. a) If  $v = (x^2 + y^2 + z^2)^{-1/2}$  5

$$\text{find } \frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2}$$

 b) Evaluate if  $E - \iint_S dS$  where  $F = 6zi + 4xj + yk$  where  $S$  is the portion of the plane  $2x + 3y + 6z = 12$ . 5