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K19U 3323

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree CBCSS (OBE) - Regular  
Examination, November - 2019  
(2019 Admissions)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS  
1C01 MAT-ST : MATHEMATICS FOR STATISTICS - I

Time : 3 Hours

Max. Marks : 40

**PART-A**  
(Short Answer)

Answer any **Four** questions out of five questions. Each question carries **1** mark. (4×1=4)

1. Write the  $n^{\text{th}}$  derivate of  $e^{mx}$ .
2. State: Cauchy's Mean Value Theorem.
3. Evaluate:  $\lim_{x \rightarrow 0} \frac{\log x}{\cot x}$
4. Write one elementary transformation of a matrix.
5. Define: Gradient vector of  $f(x, y, z) = 3xy^2 + 2x^3yz - yz^2$

**PART-B**  
(Short Essay)

Answer any **Seven** questions out of ten questions. Each question carries **2** marks. (7×2=14)

6. Find the  $n^{\text{th}}$  derivative of  $y = (ax + b)^m$ , where  $m > n$ .
7. Find  $\frac{d^2 y}{dx^2}$  if  $x = a \cos^3 \theta$ ,  $y = a \sin^3 \theta$
8. Verify Rolle's Theorem for  $f(x) = (x-1)^2$  in  $[-1, 3]$
9. Find the Maclaurin's series expansion of  $f(x) = \log(1+x)$  up to 4 terms
10. Evaluate :  $\lim_{x \rightarrow 0} \frac{x - \tan x}{x^3}$
11. Evaluate :  $\lim_{x \rightarrow 0} x^2 \operatorname{cosec} x$
12. Find the rank of  $\begin{bmatrix} 1 & -1 & 2 \\ 2 & -2 & 4 \end{bmatrix}$

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13. Using matrix method, solve :  $5x + 3y = 0, 3x - 2y = 1$
14. Find the gradient of  $\varphi(x, y, z) = x^2y + xy^2z + 5yz^3$  at  $(1, 1, 1)$
15. If  $\mathbf{a}$  is a constant vector, show that  $\text{grad}(\mathbf{a} \cdot \mathbf{r}) = \mathbf{a}$

**PART- C**  
(Essay)

Answer any **Four** Questions out of seven questions. Each question carries **3** marks. (4×3=12)

16. Find the  $n^{\text{th}}$  derivative of  $f(x) = \sin 4x \cos 2x$
17. Find the  $n^{\text{th}}$  derivative of  $x^2 \log 3x$ .
18. Using Gauss-Jordan method, find the inverse of  $\begin{bmatrix} 1 & -3 \\ 3 & 1 \end{bmatrix}$
19. Test for consistency using Rouché's method :  
 $x + y + z = 3, x + 2y + 3z = 4, 2x + 3y + 4z = 7$
20. Find the rank of the matrix  $\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 5 \\ 1 & 3 & 4 & 1 \end{bmatrix}$  by reducing to normal form.
21. Using Cramer's Rule, Solve :  
 $3x - 2y + 3z = 8, 2x + y - z = 1, 4x - 3y + 2z = 4$
22. Find the directional derivative of  $\varphi(x, y) = 3x^2y + x^2y$  at  $(1, 2)$  along  $2i + 3j$ .

**PART- D**  
(Long Essay)

Answer any **Two** questions out of four questions. Each question carries **5** marks. (2×5=10)

23. If  $y = (\sin^{-1} x)^2$ , show that  $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - n^2y_n = 0$
24. a) Find the Taylor's series expansion of  $f(x) = \sin x$  about  $x = \frac{\pi}{2}$   
b) Evaluate :  $\lim_{x \rightarrow 0} (1 + x)^{\frac{1}{x}}$
25. Solve using Matrix method :  
 $x - 3y - 8z + 10 = 0, 3x + y - 4 = 0, 2x + 5y + 6z = 13$
26. Find the divergence and curl of  $f = 3x^2y\mathbf{i} + 2yz^3\mathbf{j} - x^2z\mathbf{k}$ .