

**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**



**B.Sc. DEGREE EXAMINATION – STATISTICS**

**FIRST SEMESTER – NOVEMBER 2019**

**MT 1101 – MATHEMATICS FOR STATISTICS**

Date: 05-11-2019

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

**PART A**

**Answer all the questions:**

**(10 X 2 = 20)**

1. If  $y = 9x^4 + 5x^3 - 7x + 14$ , find the values of  $y$  when  $x = -1$  and  $x = 1$ .
2. Differentiate  $x(x^2 + 2)$  with respect to  $x$ .
3. Prove that the function  $f(x) = x^3 - 3x^2 + 6$  is positive for all values of  $x \geq 2$ .
4. State Mean value theorem.
5. Using Maclaurin's series, expand  $e^x$  as an infinite series.
6. Find the partial differential coefficients of  $u = \sin(ax + by)$ .
7. Integrate  $x^3 + 4x^2 + 3$  with respect to  $x$ .
8. Evaluate  $\int \tan\theta \, d\theta$ .
9. Write any two properties of definite integrals.
10. Find  $\int_0^2 (3x^2 + 2x + 7) \, dx$ .

**PART B**

**Answer any FIVE questions:**

**(5 X 8 = 40)**

11. Find the differential coefficient of  $\sin x \sin 2x \sin 3x \sin 4x$ .
12. Verify Rolle's theorem for the following function (i)  $f(x) = x^2 - x + 1$ ,  $x \in [0, 1]$   
(ii)  $f(x) = \sin x$  in  $[0, \pi]$ .
13. Show that for  $x > 0$ ,  $x - \frac{1}{2}x^2 < \log(1 + x) < x$ .
14. If  $u = \log(x^2 + y^2 + z^2)$ , prove that  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = \frac{2}{x^2 + y^2 + z^2}$ .
15. Integrate  $\frac{x^2 - x + 3}{x - 1}$  with respect to  $x$ .
16. Evaluate  $\int \frac{x}{\sqrt{x^2 + x + 1}} \, dx$ .
17. Prove that  $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} \, dx = \frac{\pi}{4}$ .
18. Evaluate  $\iint r\sqrt{a^2 - r^2} \, dr \, d\theta$  over the upper half of the circle  $r = a \cos \theta$ .

**PART C**

**Answer any TWO questions:**

**(2 X 20 = 40)**

19. (a) Differentiate  $\frac{2x}{(1+x)^3(1-x)^3}$  with respect to  $x$ .  
(b) Find the points of inflexion in the curve  $y = x^4 - 6x^2 + 8x - 1$ . (8+12)
20. (a) Find the maxima and minima of the function  $x^5 - 5x^4 + 5x^3 + 10$ .  
(b) Expand  $\sin x$  as an infinite series. (12+8)
21. (a) Verify Euler's theorem when  $u = x^3 - 3x^2y + 3xy^2 + y^3$ .  
(b) If  $r^2 = (x - a)^2 + (y - b)^2 + (z - c)^2$ , prove that  $\frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2} + \frac{\partial^2 r}{\partial z^2} = \frac{2}{r}$ . (10+10)
22. (a) Evaluate  $\int \frac{x}{(x-1)(x-2)(x-3)} dx$ .  
(b) Evaluate  $\iint (x^2 + y^2) dx dy$  over the region for which  $x, y \geq 0$  and  $x + y \leq 1$ . (12+8)

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