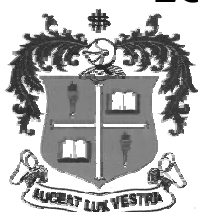


**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**



**B.Sc. DEGREE EXAMINATION – STATISTICS**  
**FIRST SEMESTER – NOVEMBER 2013**  
**MT 1101 - MATHEMATICS FOR STATISTICS**

Date : 07/11/2013  
Time : 1:00 - 4:00

Dept. No.

Max. : 100 Marks

**PART A**

**Answer all the questions:**

**(10 X 2 = 20)**

1. If  $y = 6x^3 - 2x^2 + 7x - 4$ , find the values of  $y$  when  $x = 2$  and  $x = 1$ .
2. Differentiate  $\frac{x^3}{3x-2}$  with respect to  $x$ .
3. For what values of  $x$  is  $2x^3 - 9x^2 + 12x + 4$  a decreasing function?
4. State Mean value theorem.
5. Using Maclaurin's series, expand  $\sin x$  as an infinite series.
6. Find the partial differential coefficients of  $u = \log(5x + 3y)$ .
7. Integrate  $\left(x + \frac{1}{x}\right)^2$  with respect to  $x$ .
8. Evaluate  $\int \frac{dx}{4+9x^2}$ .
9. Write any two properties of definite integrals.
10. Find  $\int_{-1}^2 (x^2 + 7x + 3) dx$ .

**PART B**

**Answer any FIVE questions:**

**(5 X 8 = 40)**

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

**PART C**

**Answer any TWO questions:**

**(2 X 20 = 40)**

19. (a) If  $f(x) = x^2 + x - 1$ , simplify  $f(3) - 7f(4) + 2f(7)$ .

(b) Differentiate  $\frac{2x}{(1+x)^3(1-x)^3}$  with respect to  $x$ .

(c) If  $y = \log(\tan e^{2x})$ , find  $\frac{dy}{dx}$ .

(d) For what values of  $x$  is the curve  $y = 3x^2 - 2x^3$  concave upwards and when is it convex upwards.  
(6+5+4+5)

20. (a) Find the maxima and minima of the function  $x^3 - 18x^2 + 96x + 4$ .

(b) Using mean value theorem, determine  $c$ , lying between  $a$  and  $b$ , when

(i)  $f(x) = x^3 - 2x^2, a = 2, b = 5$

(ii)  $f(x) = x^3 + x, a = 1, b = 2$ . (10+10)

21. (a) Verify Euler's theorem when  $u = x^3 - 3x^2y + 3xy^2 + y^3$ .

(b) If  $u = \log(x + y)$ , show that  $\frac{\partial^2 u}{\partial y \partial x} = \frac{\partial^2 u}{\partial x \partial y}$

(c) If  $V = (x^2 + y^2 + z^2)^{-\frac{1}{2}}$ , prove that  $\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0$ . (8+4+8)

22. (a) Evaluate  $\int \frac{x}{(x+1)(x+2)(x+3)} dx$ .

(b) Integrate  $\int e^x \sin 2x dx$

(c) Find  $\int_0^{\frac{\pi}{2}} \cos^{11} x dx$ . (10+7+3)

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