Roll.No. 25USTGT1001

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc Statistics- END SEMESTER EXAMINATIONS - NOVEMBER 2025
SEMESTER - I
25USTGT1001 - Mathematics for Statistics– I

Total Duration : 2 Hrs.30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Prove that $\frac{1}{n+1} + \frac{1}{2(n+1)^2} + \frac{1}{3(n+1)^3} + ... = \frac{1}{n} + \frac{1}{2n^2} + \frac{1}{3n^3} + ...$
2. Sum to infinity the series $1 + \frac{1+5}{2!} + \frac{1+5+5^2}{3!} + ...$
3. Find the n^{th} derivative of y if $y = e^{2x} \cos x \sin^2 2x$
4. Find the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ in each of the following.
   (i) $u = x \sin y, v = y \sin x$
   (ii) $u = e^x \sin y, v = x + \log \sin y$
5. Find the maximum and minimum values
   $f(x) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$
6. Express $\cos 8\theta$ in terms of $\sin \theta$
7. Express $\sin^6 \theta$ in series of cosines of multiples of θ
8. Evaluate $\int \sin^5 x dx$

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. Find the sum to infinity of the series $1 + \frac{2}{6} + \frac{2.5}{6.12} + \frac{2.5.8}{6.12.18} + ...$
10. Find the n^{th} derivative of $y = x^2 \sin x$ at $x = 0$.
11. Find the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ in each of the following.
    (i) $u = e^x \sin y, v = e^x \cos y$
    (ii) $u = 2axy, v = a(x^2 - y^2)$ where $x = r \cos \theta$ and $y = r \sin \theta$
12. Prove that $32 \cos^6 \theta = \cos^6 \theta + 6 \cos^4 \theta + 15 \cos^2 \theta + 10$
13. Find an expression to evaluate $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx$ (m, n being positive integers)
    Hence find $\int \sin^6 x \cos^3 x dx$

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