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(21223)
U. G. -I Sem.

Roll No.

NEP-1027

U. G. Examination, Dec. 2023

MAJOR COURSE (UNDER N. E. P.)

MATHEMATICS

Differential Calculus & Integral Calculus

[Paper Code : B030101T]

Time : Three Hours] *[Maximum Marks : 75*

Note : Attempt questions from all Sections as pe instructions.

Section-A

(Very Short Answer Type Questions)

Attempt all the *five* questions. Each questic carries 3 marks. Very short answer is required n exceeding 75 words. 3×5=1

1. Show that the sequence $\left\langle \frac{1}{n} \right\rangle$ has the limit 0.

2. Test the convergence of the series whose nth term is $\frac{1}{1+\left(\frac{1}{n}\right)}$.

3. Let $f(x) = x,\ x \in [0,\ 1]$. Let P be the partition $\left\{0, \frac{1}{3}, \frac{2}{3}, 1\right\}$ of $[0,\ 1]$. Compute $U(P,\ f)$ and $L(P, f)$.

4. If $\vec{r} = 3\hat{i} - 6t^2\hat{j} + 4t\hat{k}$, then find $\frac{d^2\vec{r}}{dt^2}$.

5. Find the 4th differential coefficient of $x^2 \sin 3x$.

Section-B

(Short Answer Type Questions)

Attempt any *two* questions out of the following three questions. Each question carries 7½ marks. Short answer is required not exceeding 200 words.

7½×2=15

6. Draw the graph of the function $y = |x-1| + |x-2|$ in the interval [0, 3] and discuss the differentiability of the function in the interval.

7. Trace the curve $r = a(1+\cos\theta)$.

8. Evaluate : $\int_0^\infty \frac{x^8(1-x^6)}{(1+x)^{24}}dx$.

Section-C

(Detailed Answer Type Questions)

Attempt any *three* questions out of the following five questions. Each question carries 15 marks. Answer is required in detail. 15×3=45

9. Find the coordinates of the centre of curvature for the point (x, y) on the parabola $y^2 = 4ax$. Also find the equation of the evaluate of the parabola.

10. Test for convergence of the series :

$$1 + \frac{2x}{2!} + \frac{3^2x^2}{3!} + \frac{4^3x^3}{4!} + \frac{5^4x^4}{5!} + \ldots\ldots$$

11. Verify divergence theorem for :

$$F = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$$

taken over the rectangular parallelopiped $0 \le x \le a,\ 0 \le y \le b,\ 0 \le z \le c$.

12. Show that continuity is a necessary but not a sufficient condition for the existence of a finite derivative.

13. Show that the pedal equation of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2} - \frac{r^2}{a^2b^2}$.