

B.Sc. PROGRAMME  
**Mathematics- Core**  
THIRD SEMESTER  
MODEL QUESTION PAPER

**MM 3B 03 –CALCULUS**

**Time : Three Hours**

**Maximum Weightage:30**

**I Objective Type questions (Answer all questions weightage  $12 \times \frac{1}{4} = 3$ )**

1. For what value of x is  $[z] = 0$ ?
2.  $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2} = \dots \dots \dots$
3. The linearization of  $f(x) = x^4$  at  $x = 1$  is -----
4. The horizontal asymptote of the curve  $y = \frac{1}{1-x}$  is -----
5. The function  $f(x) = \frac{|x|}{x}$  is not continued at  $x =$ -----
6. The asymptote of the function  $y = \frac{x^4 + 1}{x^2}$  is-----
7. The dominant terms of  $y = \frac{x^4 + 4}{2x}$  are-----
8.  $\sum_{k=1}^{10} k^3 =$ -----
9. Suppose f & g are continuous functions and  $\int_1^9 f(x) dx = -1$  and  $\int_7^9 f(x) dx = 5$   
then  $\int_1^7 f(x) dx = \dots \dots$
10. ----- is called the moment of the system about the origin.
11. A function is said to be.....if it has a continuous first derivative.
12. One Newton-meter of work is called a -----.

**II Short Answer Type Questions : Answer all questions**  
**(9 × 1 = 9 weightage)**

13. Find  $\lim_{x \rightarrow 0^+} \frac{|x|}{x}$  and  $\lim_{x \rightarrow 0^-} \frac{|x|}{x}$
14.  $\lim_{x \rightarrow 5} \frac{x-5}{x^2-25}$
15. State sandwich theorem
16. Prove that the exponential function is increasing in  $\mathbb{R}$
17. Give an example of a function for which  $y''$  is equal to zero at a point that is not a point of inflection. Justify.
18. Find the average value of  $f(x) = 3x^2 - 3$  on  $[0, 1]$
19. Show that the value of  $\int_0^1 \sqrt{1 + \cos x} dx$  cannot possibly be 2.

20 Use areas to evaluate the integral  $\int_{-3}^3 \sqrt{9-x^2} dx$

21. Find the work done by a force  $F(x) = \frac{1}{x^2} N$  along the x-axis from  $x = 1m$

to  $x = 10 m$ .

(9 X 1 = 9 weight)

### III Short Essay or Paragraph Questions :

**Answer any 5 questions from 7(5×2=10 weightage)**

22. Use the inequality  $\cos x \geq 1 - \frac{x^2}{2}$  which holds for all  $x$  to find a lower bound for the values of  $\int_0^1 \cos x dx$

23. Find the point of inflection of the curve  $y = (x - a)(x - b)(x - c)$ .

24. Give an example of a function  $f(x)$  with the following Properties

1)  $f$  is differential for  $x > 0$

2)  $\lim_{x \rightarrow \infty} f(x) = 2$

3)  $\lim_{x \rightarrow \infty} f(x)$  does not exist

25. Find the area of the region between the curve  $y = x^2 - 6x + 8, 0 \leq x \leq 3$  and the x axis

26. Express  $\lim_{\|p\| \rightarrow 0} \sum_{k=1}^n C_k^r \Delta x_k$  as definite integral where  $p$  is a partition of  $[0, 2]$

27. Evaluate  $\int_0^1 \frac{36}{(2x+1)^3} dx$

28. Find the area between the curve  $y = \sec^2 x, y = \tan^2 x$  and lines  $x = \frac{\pi}{4}, x = -\frac{\pi}{4}$

### IV Essay Questions : Answer any 2 questions (2×4=8 weightage)

29. test for continuity of the function  $f(x) = \begin{cases} x \sin \frac{1}{x} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$

30. Graph the function  $y = \frac{x+|x|}{2}$

31. Find the center of mass of a thin plate of constant density and covering the region bounded above by parabola  $y = 4 - x^2$  of below by the x-axis.

(2 X 4 =8 weight)

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