

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, DECEMBER 2011

(CCSS)

Mathematics—Core Course

MM 3B 03—CALCULUS

Time : Three Hours

Maximum Weightage : 30

I. Objective Type Questions. Answer *all* questions1 If $f(x) = \sqrt{x}$ and $g(x) = x + 1$, then $(g \circ f)(x) = \underline{\hspace{2cm}}$ 2 If $2 - x^2 < g(x) < 2 \cos x$ for all x , then $\lim_{x \rightarrow 0} g(x) = \underline{\hspace{2cm}}$ 3 $\lim_{u \rightarrow -3} \frac{u-1}{u} = \underline{\hspace{2cm}}$ 4 The linearization of $f(x) = x^4$ at $x = 1$ is5 A point where the graph of a function has a tangent line and where the concavity changes is called 6 The length of the longest subinterval of a partition is called its 7 A function with continuous first derivative is said to be 8 If $\int_1^2 f(x) dx = 5$, then $\int_1^2 f(u) du = \underline{\hspace{2cm}}$ 9 $\frac{d}{dx} \int_0^{\sin x} 3t dt = \underline{\hspace{2cm}}$ 10 is the force that results from gravity pulling on a mass.

11 The turning effect of a force about the origin is called

12 One Newton-. Its work is called a (12 x $\frac{1}{4}$ = 3 weightage)**II. Short answer type questions. Answer *all* questions :**13 Is $x^2 + 3x - 1$ continuous on the real line.14 If $f(x) = x + 1$, find an open interval about 4 on which $|f(x) - 5| < 0.01$.

15 State the Mean Value Theorem.

16 What is the work done by a variable force F directed along the x -axis from $x = a$ to $x = b$.

Turn over

17 What is the smallest perimeter possible for a rectangle whose area is 16 cm^2 ?

18 If f is continuous on $[a, b]$, then at some point c in $[a, b]$, $f(c) = \underline{\hspace{2cm}}$

19 Evaluate $\int_0^3 \sqrt[3]{y+1} \, dy$

20 If f and g are continuous with $f(x) \leq g(x)$ throughout $[a, b]$ then what is the area of the region between the curves $y = f(x)$ and $y = g(x)$ from a to b ?

21 What is called the centre of mass of a system?

(9 x 1 = 9 weightage)

III. Short Essay or Paragraph Questions. Answer any *five* questions from 7 :

22 Find the absolute maximum and minimum values of $f(x) = x^2$ on $[-2, 1]$.

23 Find the asymptotes of the curve $y = \frac{x+3}{x+2}$

24 Show that $f(x) = \begin{cases} 1 & \text{when } x \text{ is rational} \\ 0 & \text{when } x \text{ is irrational} \end{cases}$ is not Riemann integrable over $[0, 1]$.

25 Find the area of the region in the first quadrant that is bounded above by $y = \sqrt{x}$ and by the x -axis and the line $y = x - 2$.

26 Find the volume of the solid generated by revolving the region between the $y = \sqrt{x}$ and lines $y = 1$, $x = 4$ about the line $y = 1$.

27 Find the length of the curve $y = (x/2)^{2/3}$ from $x = 0$ to $x = 2$.

28 Show that the centre of mass of a straight, thin strip or rod of constant density lies half-way between its two ends.

(5 x 2 = 10 weightage)

IV. Essay Questions. Answer any *two* questions

29 Consider the function (defined by

$$x^2 - 1; -1 \leq x < 0$$

$$2x; 0 < x < 1$$

$$f(x) = \begin{cases} 1, & x = 1 \\ -2x + 4; & 1 < x < 2 \\ 0; & 2 < x < 3 \end{cases}$$

$$-2x + 4; 1 < x < 2$$

$$0; 2 < x < 3$$

(a) Find $f(-1)$.

(b) Does $\lim_{x \rightarrow 1} f(x)$ exist.

(c) Does $\lim_{x \rightarrow 1} f(x) = f(1)$?

(d) Is f continuous at $x = -1$.

30 State and prove the fundamental theorem of Calculus.

31 Find the area of the surface generated by revolving the curve $y = x^2$, $0 < x < \frac{1}{2}$ about x -axis.

(2 x 4 = 8 weightage)