

Name.....

Reg. No.....

**FIRST SEMESTER B.Sc DEGREE (SUPPLEMENTARY/IMPROVEMENT)  
EXAMINATION, NOVEMBER 2014**

(U.G.-CCSS)

Complementary Course—Mathematics

MM 1C 01—MATHEMATICS

Time : Three Hours

Maximum : 30 Weightage

**Part A (Objective Type Questions)***Answer all twelve questions.**Each bunch of four questions carries 1 weightage.*

1. Find  $\text{Lt}_{x \rightarrow -2} \sqrt{4x^2 - 3}$ .
2. The functions  $f(x) = \frac{\cos x}{x}$  is not continuous at  $x = \underline{\hspace{2cm}}$ .
3. Find  $\frac{dr}{d\theta} \Big|_{\theta=0}$  if  $r = \frac{2}{\sqrt{4-\theta}}$ .
4. The formula for finding the sum of the cubes of first  $n$  natural numbers is  $\underline{\hspace{2cm}}$ .  
(4 × ¼ = 1 weightage)
5. State mean value theorem.
6. Express  $\lim_{|p| \rightarrow 0} \sum_{k=1}^n \sec(c_k) \Delta x_k$  as an integral if  $p$  denotes a partition of the interval  $\left[\frac{-\pi}{4}, 0\right]$ .
7. Evaluate  $\int_{\sqrt{2}}^{\sqrt{18}} \sqrt{2} dr$ .
8. If  $\int_1^2 f(x) dx = 5$  then  $\int_2^1 f(t) dt = \underline{\hspace{2cm}}$ .  
(4 × ¼ = 1 weightage)
9. Find the average value of  $f(t) = \sin t$  on  $[0, 2\pi]$ .
10. The critical points of  $f(x) = x^3 - 12x + 4$  are  $\underline{\hspace{2cm}}$ .
11. If  $f'(x) = 2x$  for all  $x$  and  $f(1) = 0$  then  $f(x) = \underline{\hspace{2cm}}$ .
12. Use L' Hopital's rule find  $\text{Lt}_{t \rightarrow 0} \frac{\sin 5t}{t}$ .  
(4 × ¼ = 1 weightage)

Turn

### Part B (Short Answer Type Questions)

Answer all nine questions.  
Each question carries 1 weightage.

13. If  $\sqrt{5-2x^2} \leq f(x) \leq \sqrt{5-x^2}$  for  $-1 \leq x \leq 1$ , find  $\lim_{x \rightarrow 0} f(x)$ .
14. Suppose  $\lim_{x \rightarrow -2} p(x) = 4$ ,  $\lim_{x \rightarrow -2} r(x) = 0$  and  $\lim_{x \rightarrow -2} s(x) = -3$ . Find  $\lim_{x \rightarrow -2} \left[ -4p(x) + \frac{5r(x)}{s(x)} \right]$ .
15. Find the slope and equation of the tangent at the point  $(4, 2)$  to the curve  $f(x) = \sqrt{x}$ .
16. Find the 1<sup>st</sup> and second derivatives of the function  $s = \frac{t^2 + 5t + 1}{t^2}$ .
17. Find the linearization of  $f(x) = x^3 - x$  at  $x = 1$ .
18. Evaluate  $\frac{d}{dx} \int_1^{\sin x} 3t^2 dt$ .
19. Find the length of the curve  $x = \frac{y^3}{3} + \frac{1}{4y}$  from  $y = 1$  to  $y = 3$ .
20. Find the area of the surface generated by revolving the curve  $y = 2\sqrt{x}$ ,  $1 \leq x \leq 2$  about the  $x$ -axis.
21. Find the points at which the curve  $y = x^4 - 2x^2 + 2$  has horizontal tangents.

(9 × 1 = 9 weightage)

### Part C (Short Essay Questions)

Answer any five questions.  
Each question carries 2 weightage.

22. If  $f(x) = \sqrt{19-x}$ ,  $L = 3$ ,  $x_0 = 10$ ,  $\epsilon = 1$ , find an open interval containing  $x_0$  and a value of  $\delta > 0$  such that  $0 < |x - x_0| < \delta$  implies  $|f(x) - L| < \epsilon$ .
23. The curves  $y = x^2 + ax + b$  and  $y = cx - x^2$  have a common tangent line at the point  $(1, 0)$ . Find  $a$ ,  $b$  and  $c$ .
24. Using Sandwich theorem find the asymptotes of the curve  $y = 2 + \frac{\sin x}{x}$ .
25. Find the area of the region between the  $x$ -axis and the curve  $f(x) = x^3 - x^2 - 2x$ ;  $-1 \leq x \leq 2$ .
26. Use max-min inequality find upper and lower bounds for the value of  $\int_0^1 \frac{1}{1+x^2} dx$ .



17. Find the volume of the solid generated by revolving the region bounded by  $y = \sqrt{x}$  and the lines  $y = 1$ ,  $x = 4$  about the line  $y = 1$ .
18. Find the absolute maximum and minimum values of  $f(x) = x^{\frac{1}{2}}$  in  $[-1, 8]$ .

**Part D (Essay Questions)**

(5 × 2 = 10 weightage)

Answer any two questions.  
Each question carries 4 weightage.

Graph the function :  $f(x) = \begin{cases} 1, & x \leq -1 \\ -x, & -1 < x < 0 \\ 1, & x = 0 \\ -x, & 0 < x < 1 \\ 1, & x \geq 1 \end{cases}$

Then write the one sided limits, limits, one-sided continuity and continuity of  $f$  at each of the points  $x = -1, 0$  and  $1$ . Are any of the discontinuities removable? Explain.

19. Find  $y'$  and  $y''$  and graph the function  $y = x^{\frac{1}{2}} - 5x^{\frac{3}{2}}$ . Include the coordinates of any local extreme points and inflection points.
20. Find the area of the surface generated by revolving the curve  $y = 2\sqrt{x}$ ,  $1 \leq x \leq 2$  about the  $x$ -axis.

(2 × 4 = 8 weightage)