



Bachelor Level / First Year/ First Semester/ Science  
Computer Science and Information Technology (MTH. 112)  
(Mathematics I)  
(NEW COURSE)

Full Marks: 80  
Pass Marks: 32  
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.  
The figures in the margin indicate full marks.

Attempt any three questions:

(3×10=30)

✓ 1. (a) A function is defined by  $f(x) = |x|$ , calculate  $f(-3)$ ,  $f(4)$ , and sketch the graph. (5)

(b) Prove that the  $\lim_{x \rightarrow 2} \frac{|x-2|}{x-2}$  does not exist. (5)

✓ 2. (a) Find the domain and sketch the graph of the function  $f(x) = x^2 - 6x$ . (10) (5)

(b) Estimate the area between the curve  $y = x^2$  and the lines  $y = 1$  and  $y = 2$ . (5)

✓ 3. (a) Find the Maclaurin series for  $\cos x$  and prove that it represents  $\cos x$  for all  $x$ . (4)

(b) Define initial value problem. Solve that initial value problem of  $y' + 2y = 3$ ,  $y(0) = 1$ . (4)

(c) Find the volume of a sphere of radius  $a$ . (2)

4. (a) If  $f(x, y) = \frac{y}{x'}$  does  $\lim_{(x, y) \rightarrow (0, 0)} f(x, y)$  exist? Justify. (5)

(b) Calculate  $\iint_R f(x, y) dA$  for  $f(x, y) = 100 - 6x^2y$  and  $R: 0 \leq x \leq 2, -1 \leq y \leq 1$ . (5)

Attempt any ten questions:

(10×5=50)

✓ 5. If  $f(x) = \sqrt{2-x}$  and  $g(x) = \sqrt{x}$ , find  $f \circ g$  and  $f \circ f$ . (5)

✓ 6. Define continuity on an interval. Show that the function  $f(x) = 1 - \sqrt{1-x^2}$  is continuous on the interval  $[-1, 1]$ . (5)

✓ 7. Verify Mean value theorem of  $f(x) = x^3 - 3x + 2$  for  $[-1, 2]$ . (5)

✓ 8. Starting with  $x_1 = 2$ , find the third approximation  $x_3$  to the root of the equation  $x^3 - 2x - 5 = 0$ . (5)

✓ 9. Evaluate  $\int_0^{\infty} x^3 \sqrt{1-x^4} dx$ . (5)

✓ 10. Find the volume of the resulting solid which is enclosed by the curve  $y = x$  and  $y = x^2$  is rotated about the  $x$ -axis. (5)

✓ 11. Find the solution of  $y'' + 4y' + 4 = 0$

$$e^2 \int_0^1 dx - \int_0^1 \frac{d}{dx} \left( \frac{5}{2} \right) \left( \frac{d}{dx} a^2 \right)$$

$$(1)^n a^2 - 2x \cdot a^2$$

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12. Determine whether the series  $\sum_{n=1}^{\infty} \frac{n^2}{5n^2 + 4}$  converges or diverges. (5)

✓ 13. If  $\mathbf{a} = (4, 0, 3)$  and  $\mathbf{b} = (-2, 1, 5)$  find  $|\mathbf{a}|$ , the vector  $\mathbf{a} - \mathbf{b}$  and  $2\mathbf{a} + 5\mathbf{b}$ . (1+2+2)

✓ 14. Find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$  if  $z$  is defined as a function of  $x$  and  $y$  by the equation  $x^3 + y^3 + z^3 + 6xyz = 1$ . (5)

✓ 15. Find the extreme values of the function  $f(x, y) = x^2 + 2y^2$  on the circle  $x^2 + y^2 = 1$  (5)