Tribhuvan University
Institute of Science and Technology
2075

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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 for 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 $\lim_{x \to 2} \dfrac{|x-2|}{x-2}$ does not exist.   (5)

2. (a) Find the domain and sketch the graph of the function $f(x) = x^2 - 6x$.   (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 $f(x, y) = \dfrac{y}{x'}$ does $\lim_{(x, y) \to (0,0)}$ f(x, y) exist? Justify.   (5)

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

Attempt **any ten** questions: (10×5=50)

5. If $f(x) = \sqrt{2-x}$ and $g(x) = \sqrt{x}$, find fog and fof.   (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 $x_1 = 2$, fine 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 in enclosed by the curve y = x and y = x^2 is rotated about the x – sxis.   (5)

11. Find the solution of $y'' + 4y' + 4 = 0$ (5)

12. Determine whether the series $\sum_{n=1}^{\infty} \dfrac{n^2}{5n^2 + 4}$ 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 $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$ 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)