Tribhuvan University
Institute of Science and Technology
2081
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Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (MTH 117)
(Mathematics I)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
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.

Section A

Attempt any TWO questions.   [2×10=20]

1. (a) Determine whether each of the following functions is even, odd, or neither even nor odd. Also, sketch the graph of each of the functions:
   (i) $f(x) = x^5 + x$ (ii) $g(x) = 2x - x^2$.   [1+1+3]
   (b) Find the value of $\lim\limits_{x \to 4} \dfrac{\sqrt{x} - 2}{x^2 - 16}$.   [5]

2. (a) Use Newton's method to find $\sqrt[6]{2}$ correct to five decimal places.   [5]
   (b) What do you mean by ordinary differential equation of first order? Differentiate linear and non linear differential equation. Find the order of the differential equation $\left(\dfrac{d^2y}{dx^2}\right)^3 = \left(\dfrac{dy}{dx}\right)^4$.   [1.5+2+1.5]

3. (a) Find the Maclaurin series of the function $f(x) = e^x$ and its radius of convergence.   [3+2]
   (b) Find a vector equation and parametric equations for the line that passes through the point $(5, 1, 3)$ and is parallel to the vector $\vec{i} + 4\vec{j} - 2\vec{k}$. Also, find two other points on the line.   [4+1]
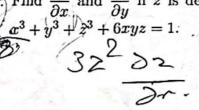
Section B

Attempt any EIGHT questions   [8×5=40]
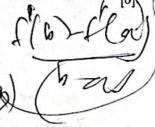
4. Integrate $\displaystyle\int_1^9 \dfrac{x-1}{\sqrt{x}}\, dx$.   [5]

5. State Mean value theorem and verify this for $f(x) = x^2 - 4x - 3$ in the interval $[1, 4]$.   [2+3]

6. Find two positive numbers whose product is 100 and whose sum is a minimum.   [5]

7. Find $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$ if z is defined implicitly as a function of x and y by the equation $x^3 + y^3 + z^3 + 6xyz = 1$.   [5]

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8. Compare the value of $\triangle y$ and dy if $y = x^3 + x^2 - 2x + 1$ and x changes from 1 to 1.05.

[5]

9. Find the area of the region enclosed by the parabola $y = x^2$ and the line $y = 2$.   [5]

10. Determine whether the series $\sum\limits_{n=1}^{\infty} \dfrac{1}{n^2+1}$ converges or diverges.   [5]

11. If $f(x) = x^2 + 2$, then find the range and domain of $f(x)$.   [3+2]

12. Identify the separable differential equations
    (i) $y' = x + 2$ (ii) $y' = xy + 4x - 7y$ (iii) $y' = \ln y$ (iv) $y' = \sin(xy)$.   [5]