Tribhuvan University
Institute of Science and Technology
2081
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Bachelor Level / First Year/ First Semester/ Science | Full Marks: 80
Computer Science and Information Technology (MTH 112) | Pass Marks: 32
(Mathematics I) | Time: 3 hours.
(OLD COURSE)

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 THREE questions. [3×10=30]

1. (a) If $f(x) = x^2$, $g(x) = \sqrt{x}$, then find $(f o g)(-3)$ and $(g o f)(-3)$. [5]
   (b) Evaluate: $\lim\limits_{x \to 0} \dfrac{2 - \sqrt{x+4}}{x}$. [5]

2. (a) Find the derivative of $y = \dfrac{x}{x^3 + 2}$. [5]
   (b) Estimate the area between the parabola $y = x^2$ and the line $y = x$. [5]

3. (a) Verify the Mean value theorem for the function $f(x) = x^2 + 3x$ in $x \in [1,3]$. [5]
   (b) Define initial value problem. Solve the equation $xy' + y = x$, $y(1) = 0$. [1+4]

4. (a) Find the maximum and minimum values of the function $f(x) = 3 - 2x^2$ for $[-1, 2]$.
      What is the slope of the graph $y = f(x)$ at these points? [5]
   (b) Find $\vec{a}.\vec{b}$ and $\vec{a} \times \vec{b}$, where $\vec{a} = 2\vec{i} + 3\vec{j} - 2\vec{k}$ and $\vec{b} = -\vec{i} + 2\vec{j} - 3\vec{k}$. [5]

Section B

Attempt any TEN questions [10×5=50]

5. Verify Rolle's theorem $f(x) = x^2 + 1$ in $x \in [-1, 1]$. [5]

6. Find the Maclaurin series expansion of $\ln x$. [5]

7. If $f(x) = x^3 - 2$, then find $f(-2)$, $f(2)$, $f(0)$, $f(-1)$ and $f(a)$. [5]

8. In which domain the function $h(x) = \sin x^2$ is continuous? Discuss. [5]

9. Evaluate: $\displaystyle\int_0^1 \dfrac{x}{\sqrt{1-x^2}} \, dx$. [5]

10. Sketch the curve $f(x) = 2x - x^2$. [5]

11. Find the solution of $y'' + 4y' + 4y = 0$. [5]

12. Test whether the sequence $a_n = \dfrac{n}{\sqrt{9+n}}$ diverges or converges. [5]

13. Evaluate the limit by using L'Hospital rule $\lim\limits_{x \to 2} \dfrac{x^4 - 16}{x^3 - 8}$

[5]

14. Find the second order partial derivatives f_{xx}, f_{xy} and f_{yy} of $f(x,y) = x^4 + xy^3 - 2x^3$.

[5]

15. Find the length of the arc of the semi-cubical parabola $y^2 = x^3$ between the points $(1,1)$ and $(4,8)$.

[5]