

Tribhuvan University
Institute of Science and Technology
2073

Bachelor Level / First Semester / Science

Computer Science and Information Technology(MTH112)

((TU CSIT) Mathematics I (Calculus))

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Full marks: 80

Pass marks: 32

Time: 3 hours

Attempt all questions.

Group A (10×2=20)

1. If $f(x) = \sin x$ and $g(x) = -x/2$. Find $f(f(x))$ and $g(f(x))$.

2. Define critical point. Find the critical point of $f(x) = 2x^2$.

3. Evaluate $\lim_{x \rightarrow 1} \frac{a-b^4}{x}$.

4. Find the equation of the parabola with vertex at the origin and directrix at $x = 7$.

5. Find a vector parallel to the line of intersection of the planes $3x + 6y - 2z = 5$.

6. Evaluate $\int_{-1}^0 \int_{-1}^1 (x + y + 1) dx dy$.

7. Find $\frac{dt}{dx}$ and $\frac{dt}{dy}$ if $f(x,y) = x^2 + y^2$

8. Evaluate $\log_{(x,y) \rightarrow (0,1)} \frac{x-xy+k}{x}$

9. Show that $y = ax^2 + b$ is the solution of $xy'' + y' = 0$.

10. Solve $\frac{d^2y}{dx^2} - y = 0$

Group B (5×4=20)

11. Verify Rolle's theorem for $f(x) = x^3$, $x \in [-3,3]$.

12. Find the Taylor series expansion of the case at e^x , at $x=0$.

13. Find a Cartesian equivalent of the polar equation $r \cos(\theta - \pi/3) = 3$.

$$(x, y) \rightarrow (0,0) \frac{2y^2}{\sqrt{x^2+xy}}$$

14. Evaluate it

$$(y - z) \frac{dz}{dx} + (x - y) \frac{dz}{dy} = z - x$$

15. Obtain the general solution of

Group C (5×8=40)

$$(a) \int_{-1}^{\infty} \frac{dx}{x} \quad (b) \int_{-1}^{\infty} \frac{dx}{x^2}$$

16. Evaluate the integrals and determine whether they converge or diverge

OR

Find the area bounded on the parabola $y = 2 - x^2$ and the line $y = -x$.

$$\vec{R}(t) = (a \cos \omega t) \vec{i} + (a \sin \omega t) \vec{j} + (bt) \vec{k}$$

17. Find the curvature of the helix

18. Find the volume enclosed between the surfaces $z = x^2 + 3y^2$ and $z = 8 - x^2 - y^2$

19. Find the extreme values of the function $F(x, y) = xy - x^2 - y^2 - 2x - 2y + 4$

OR

Find the extreme values of $f(x, y) = xy$ subject to $g(x, y) = x^2 + y^2 - 10 = 0$.

20. Define second order partial differential equation. Define initial boundary value problem. Derive the heat equation or wave equation in one dimension.