

Tribhuvan University
Institute of Science and Technology
2071

Bachelor Level/ First Year/ First Semester/ Science
Computer Science and Information Technology (MTH:104)
(Calculus and analytical Geometry)
Old 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 all questions.

Group A (10×2=20)

1. If $f(x) = x + 2$ and $g(x) = x^3 - 3$ find $g(f(3))$.
2. Show that the area under the arch of the curve $y = \sin x$ is.
3. Test the convergence of the series $\lim_{n \rightarrow \infty} \frac{a-bn^3}{n^3-c}$.
4. Find the equation of the parabola with vertex at the origin and focus at (0,2).
5. Find the angle between the planes $3x - 6y - 2z = 7$ and $2x + y - 2z = 5$
6. Evaluate $\int_1^2 \int_y^{y^2} dx dy$.
7. Find $\frac{df}{dx}$ and $\frac{df}{dy}$ if $f(x, y) = 10 - x^2 - y^2$.
8. Prove that $u_{xy} = u_{yx}$ if $u = 1/n(2x + 3y)$
9. Show that $y = \frac{1}{2}e^x + be^{-x}$ is a solution of $\frac{dy}{dx} + y = e^x$
10. Solve $\frac{d^2y}{dx^2} + w^2y = 0$.

Group B (5×4=20)

11. Verify Rolle's theorem for the function $f(x) = x^2 - 5x + 7$ in the interval [2,3].
12. Find the Taylor's series expression of $f(x) = \sin x$ at $x = 0$.
13. Obtain the polar equations for circles through the origin centered on x and y axis, with radius a.
14. Evaluate $\lim_{(x,y) \rightarrow (0,0)} \frac{2y^2}{x^2+xy}$.

15. Obtain the general solution of $(y - z) \frac{dz}{dx} + (x - y) \frac{dz}{dy} = z - x$

Group C (5×8=40)

16. State Lagrange's mean value theorem and verify the theorem for
 $x = x^3 - x^2 - 5x + 3$ in $[0,4]$.

Or

Investigates the convergence of the integrals

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

(b) $\int_0^3 \frac{dx}{(x-1)^{\frac{2}{3}}}$

- 17.** Define curvature of a curve .Show that the curvature of a (a) straight line on zero and (b) a circle of a radius a is $1/a$
- 18.** Find the volume enclosed between the surfaces $Z = x^2 + 3y^2$ and $Z = 8 - x^2 - y^2$
- 19.** Find the maximum and minimum of the function $f(x, y) = x^3 + y^3 - 12x + 20$.

OR

Find the Point on the ellipse $x^2 + 2y^2 = 1$ where $f(x, y) = xy$ has its extreme values.

- 20.** Define second order partial differential equation .What is initial boundary values problem ?Solve : $u_t = u_{xx} = u_{tt} = u_{xx}$