# Tribhuvan University
## Institute of Science and Technology
## 2074

Bachelor Level/ First Year/ First Semester/ Science — Full Marks: 80
**Computer Science and Information Technology (MTH:112)** — Pass Marks: 32
(New Courses) — 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 all questions.**

### Group A (10×2=20)

**1.** (a) A function is defined by f(x) = $\begin{cases} x+2 \ if \ x<0 \\ 1-x \ if \ x>0 \end{cases}$, calculate f(-1),f(3), and sketch the graph.(5)

(b) Prove that the $\lim_{x\to 0} \frac{|x|}{x}$ does not exist.

**2.** (a) Find the derivative of $f(x)=\sqrt{x}$ and to state the domain of $f'$

(b) Estimate the area between the curve $y^2 = x$ and the lines x=0 and x=2.

**3.** (a) Find the Maclaurin series for $e^x$ and prove that it represents $e^x$ for all $x$.

(b) Define initial value problem. Solve that initial value problem of $y+5y=1, y(0)=2$.

(c) Find the volume of a sphere of radius r.

**4.** (a) For what value of x does the series $\sum_{n=1}^{\infty} \frac{(x-3)^n}{x}$ converge?

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

### Group B (5×4=20)

**Attempt any ten question**

**5.** If $f(x)=\sqrt{x}\ and\ g(x)=\sqrt{3-x}$, find gof and gog.

**6.** Use continuity to evaluate the limit , $\lim_{x\to 4} \frac{5+\sqrt{x}}{\sqrt{5+x}}$.

**7.** Verify Mean value theorem of $f(x)=x^3-3x+3\ for\ [-1,2]$.

**8.** Sketch the curve $y=x^3+x$

**9.** Determine whether the integer $\int_1^{\infty} \frac{1}{x} dx$ is convergent or divergent .

### Group C (5×8=40)

**10.** Find the length of the area of the semicubical parabola $y^2 = x^2$ between the point (1,1) and (4,8).

**11.** Find the solution of $y'' + 6y' + 9 = 0, y(0) = 2, y(0) = 1$.

**12.** Test the convergence of the series $\sum_{n=1}^{n} \frac{n^n}{n!}$.

**13.** Define cross product of two vectors .if a=i+3j +4k and b-= 2i+7j=5k, find the vector $a \times b$ *and* $b \times a$.

14. Define limit of a function . find $\lim_{x\to\infty}(x - \sqrt{x})$.

15. Find the extreme value of $f(x, y) = y^2 - x^2$