POKHARA UNIVERSITY

Level: Bachelor	Semester – Spring	Year: 2020
Program: BE		Full Marks: 70
Course: Engineering Mathematics I		Pass Marks: 31.5
		Time: **2** hrs.

Candidates are required to answer in their own words as far as practicable. The figures in the margin indicate full marks.

Group - A: Attempt all questions (5×10=50)

Q. N. 1 a) Suppose that f is an even function of x. Does knowing that $\lim_{x\to 2^-} f(x) = 7$ tell you anything about either $\lim_{x\to -2^-} f(x)$ or $\lim_{x\to -2^+} f(x)$? Give reasons for your answer. 3.5+3.5+3

b) For what values of x, if any y' is positive? zero? negative?

c) Show that the function $f(x) = \begin{cases} x & for \quad x < 1 \\ 2 - x & for \quad 1 \le x < 2 \\ -2 + 3x - x^2 & for \quad x \ge 2 \end{cases}$

is continuous at x = 1 but not differentiable at x = 1.

OR

a) State Mean Value Theorem, using it find the values of a, m, and b of the function $f(x) = \begin{cases} 3 & x = 0 \\ -x^2 + 3x + a & 0 < x < 1 \\ mx + b & 1 \le x \le 2 \end{cases}$, where f(x) satisfied the conditions of MVT in [0, 2]. 4+3+3

b) Suppose that f is differentiable on [0,1] and that its derivative is never zero. Show that $f(0) \neq f(1)$.

c) Suppose that f is differentiable on [a,b] and that f(b)<f(a) . Can you then say anything about the values of f' on [a,b]?

Q. N. 2 a) Define conic section and classify them with respect to eccentricity. 2+1+3+4

b) For what value of e the ellipse reduces to the circle?

c) Derive standard equation of hyperbola.

d) The foci of the hyperbola coincide with the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$.

Find the equation of hyperbola with eccentricity 2.

Q. N. 3 a**)** What is definite and indefinite integral? 1+2+3+4

b) How does the method of substitution work for definite integrals? Give examples.

c)Verify the integral $\int_0^1 \frac{\log(1+x)dx}{1+x^2} = \frac{\pi}{8}\log 2$.

d)Show that $\int_0^{\pi} 2\sin^2 x \, dx = \pi$. How close do you come to this value by using trapezoidal rule with n=6? Simpson's rule with n=6?

Q. N. 4 a) Find the area of the propeller –shaped region enclosed by the curves $x - y^{\frac{1}{3}} = 0$ and the line $x - y^{\frac{1}{5}} = 0$. 5+5

b) Find the volume of the solid generated by revolving the region bounded by the parabola $y = x^2$ and the line y=1 about

i) the line y=1; ii) the line y=2; iii) the line y = -1.

Q. N. 5 a) How you define the term indeterminate form. Justify with the fact that 1^{∞} is an indeterminate form. 2+4+4

b) Find the asymptotes of the curve:

$$x^3 + 3x^2y - xy^2 - 3y^3 + x^2 - 2xy + 3y^2 + 4x + 5 = 0$$

c)Define the physical meaning of the curvature. Find the radius of curvature at origin of the following curve as; $x^4 + y^2 = 6a(x+y)$.

Group - B: (1×20=20)

Q. N. 6 a) Let $\vec{v}$ be a vector in the plane not parallel to the y-axis. How is the slope of $-\vec{v}$ related to the slope of $\vec{v}$? Give reasons for your answer. 5+5+5+5

b) Explain briefly how the value of scalar triple product of three vector is zero if all the vectors are co-planer.

c) Find a plane through the origin that meets the plane M; 2x+3y+z=12 in a right angle. How do you know that your plane is perpendicular to M?

d) In the line x= 1-2t, y=2+5t, z=-3t parallel to the plane 2x+y-z =8? Give reasons for your answer.