Total No. of printed pages = 7

END SEMESTER REGULAR EXAMINATION, MAY/JUNE-2025

Semester : 2nd (NEP)

Branch : Common to all

Course Code : BS-201

MATHEMATICS-II

Full Marks – 60

Pass Mark – 24

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

(i) Objective Questions, (Q. Nos. 1–4) are compulsory.

(ii) Answer any *five* from the rest of questions. (from Q. No. 5 to Q. No. 11)

1. Fill in the blanks : $1\times4=4$

(a) $\lim\limits_{x\to0}\dfrac{e^x-1}{x}=?$

(b) $f(x)=x\left(x-\dfrac{1}{7}\right)(x-1)$ then $f\left(\dfrac{1}{7}\right)$.....?

[Turn over

(c) For parabola $y^2 = 4ax$, eccentricity e = ?

(d) $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = ?$

2. Answer the following questions : 1×4=4

(a) Define even function.

(b) If f(x) = log(x) then f(xy) = f(x) + f(y). Is it true ?

(c) State Dirichlet's function.

(d) The coordinate of any point in yz plane will be _____ ?

3. Choose the correct answers : 1×3=3

(a) Mode =

(i) 3 Median – 2 Mean

(ii) 3 Mean – 2 Median

(iii) 2 Median – 3 Mean

(iv) None of these

(b) $\lim_{\theta\to 0} \frac{\sin 13\theta}{\theta} = ?$

(i) 1 (ii) 0

(iii) 13 (iv) None of these

(c) Equation of the tangent to the circle $x^2+y^2+2gx+2fy+c=0$, at P(a, b) is

(i) $\frac{y-b}{x-a} = -\frac{g+a}{f+b}$

(ii) $\frac{y-b}{x-a} = \frac{g+a}{f+b}$

(iii) $\frac{y-a}{x-b} = \frac{g+a}{f+b}$

(iv) None of these.

4 Match the following Columns : 1×4=4

Column–A	Column-B
(a) $\frac{d\log x}{dx} = ?$ at $x=1$	(i) 12
(b) $\sigma = \sqrt{\frac{\sum fd'^2}{N} - \left(\frac{\sum fd'}{N}\right)^2}$	(ii) 1
(c) $\lim_{x\to 0}\left(1+\frac{1}{x}\right)^x =$	(iii) Standard deviation
(d) $\frac{d^2y}{dx^2}$ of $y = 6x^2$ is	(iv) e

5. Answer *all* parts from Q. No 5. 2+4+3=9

(a) Define continuity of a function at the point $x = p$.

(b) Examine the continuity of the following function at the point $x = 1$.

$$f(x) = -x \quad \text{for } x \leq 0$$
$$= x \quad \text{for } 0 < x < 1$$
$$= 2-x \quad \text{for } x \geq 1.$$

(c) Find $f'(x)$ of $y = \sqrt{x}$ from first principle.

6. Find the limits of the followings : (any 3 parts) 3×3=9

(i) $\lim\limits_{x \to 2} \dfrac{\sqrt{x} - \sqrt{2}}{x-2}$ (ii) $\lim\limits_{\theta \to 0} \dfrac{\sin 5\theta}{\sin 7\theta}$

(iii) $\lim\limits_{x \to \infty} \dfrac{9x^2 + 5x - 3}{x^2 + x}$ (iv) $\lim\limits_{x \to 0} \dfrac{(1+x)^2 - 1}{x}$

(v) $\lim\limits_{x \to 0} \dfrac{4^x - 2^x}{x}$.

7. Find the $\dfrac{dy}{dx}$ of the followings : (any 3 parts) 3×3=9

(i) $y = \cos(x^3 + 4x + 3)$

(ii) $y = \log(\log x)$

(iii) $x^2 + 2xy + y^2 = 0$

(iv) $y = e^x \sin x$

(v) $x = t^2 + 1, \quad y = 2t$.

8. Answer *all* parts from Q. No 8. 3×3=9

(a) Show that maximum of $f(x) = x + \dfrac{1}{x}$ is less than its minimum value.

(b) If $y = \dfrac{1}{x}$ prove that $\dfrac{dy}{dx} + \dfrac{y}{x} = 0$.

(c) State geometric interpretation of definite integral $\int_a^b f(x)dx$.

9. Answer *all* parts from Q. No. 9.

(a) Answer any *two* parts : 3+3=6

(i) $\int \dfrac{\cos\sqrt{x}}{\sqrt{x}} dx$

(ii) $\int \dfrac{e^{5x} + e^{3x}}{e^x + e^{-x}} dx$.

(iii) $\int\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2 dx$

(iv) $\int\frac{1}{\sin^2 x\cos^2 x}dx$

(v) $\int_0^1 \log x dx$.

(b) Find the area of the curve bounded by $y^2 = 12x$, the x-axis and the semi latus rectum. 3

10. Answer *all* parts from Q. No. 10. 3+3+3=9

(a) Find the equation of the circle passing through (1, 0) ; (2, 3) and (3, –1).

(b) (i) Find the equation of the ellipse passing through foci (– 3, 0) and (3 ,0) and eccentricity e is $\frac{1}{2}$.

Or

(ii) Find the equation of the tangent to the parabola $y^2 = 2x$ at (2, –2) .

(c) Show that the points (–2, 3, 5) (1, 2, 3) and (7, 0, –1) are collinear .

11. Answer *all* parts from Q. No. 11. 2+2+5=9

(a) State two merits of Median and Mode.

(b) From the following data find the Standard deviation :

Age : in yrs.	50-55	45-50	40-45	35-40	30-35	25-30
No of : labours	22	29	31	47	51	70