

18010

**B.C.A. Examination, May-2025**

**MATHEMATICS-II**

[BCA-201]

Time : Three Hours ] [Maximum Marks : 75

**Note :** Attempt questions from **all** the sections as per instructions.

**Section-A**

**(Very Short Answer Type Questions)**

**Note :** Attempt all the **five** questions. Each question carries **3** marks.

1. Which of the following sets are finite and which are infinite: 3
  - (i) The set of the natural numbers divisible by 2.
  - (ii) The set of natural numbers less than 10.
  - (iii) The set of lines passing through a point.

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2. If  $f:A \rightarrow B$  such that  $f(x)=2x+1$  and  $g: B \rightarrow C$  such that  $g(y)=y^2$ , find  $f \circ g(y)$ . 3
3. Draw the Hasse diagram of  $(P(A), \subseteq)$  for  $A=\{a,b\}$ . 3
4. If  $u = \frac{x^{1/4} + y^{1/4}}{x^{1/5} + y^{1/5}}$ , then evaluate  $-\left(x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}\right)$ . 3
5. Find the coordinates of a point which divides the join of  $(2,3,4)$  and  $(3,-4,7)$  in the ratio  $2:-4$ . 3

**Section-B**

**(Short Answer Type Questions)**

**Note :** Attempt any **two** questions. Each question carries **7½** marks.

6. If  $f(x) = \log\left(\frac{1+x}{1-x}\right)$ , then show that  $f(x) + f(y) = f\left(\frac{x+y}{1+xy}\right)$  7½
7. Prove that the dual of a lattice is a lattice. 7½
8. If  $u=f(x-y, y-z, z-x)$ , then prove that  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$  7½

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### Section-C

#### (Long Answer Type Questions)

**Note :** Attempt any **three** questions. Each question carries **15** marks.

9. (a) In a class of 120 students, 80 have taken mathematics, 40 have taken both mathematics and statistics and all students have taken at least one of the two subjects. Find  $7\frac{1}{2}$
- (i) How many students have taken only statistics and not mathematics?
- (ii) How many students have taken statistics?
- (b) If  $R = \{(1,1), (2,2), (2,3), (3,2), (4,2), (4,4)\}$  be the relation in  $A = \{1,2,3,4\}$ . Determine whether the relation R is reflexive, symmetric and transitive.  $7\frac{1}{2}$
10. (a) If L be a lattice, then prove that  $a \wedge b = a$  if and only if  $a \vee b = b$ .  $7\frac{1}{2}$

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- (b) Show that the poset  $(S_{30}, /)$  is a lattice. Also draw the Hasse diagram.  $7\frac{1}{2}$

11. (a) If  $u = x^2y + y^2z + z^2x$ , then prove that  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = (x + y + z)^2$   $7\frac{1}{2}$
- (b) Find the maximum and minimum values of  $f(x,y) = xy(a-x-y)$ .  $7\frac{1}{2}$
12. (a) A line makes angles  $\alpha, \beta, \gamma, \delta$  with the four diagonals of a cube, prove that  $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$ .  $7\frac{1}{2}$
- (b) Find the equation of the plane which passes through the points  $A(0,1,1)$ ,  $B(1,1,2)$  and  $C(-1,2,-2)$ .  $7\frac{1}{2}$
13. (a) Find the area of a plate in the form of a quadrant of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  by double integration.  $7\frac{1}{2}$
- (b) Find the volume of the tetrahedron bounded by the plane  $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$  and the coordinate plane.  $7\frac{1}{2}$

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