



K20U 0882

Reg. No. : .....

Name : .....

IV Semester B.Sc. Degree (CBCSS-Reg./Sup./Imp.) Examination, April 2020  
(2017 Admn. Onwards)

**CORE COURSE IN MATHEMATICS**  
**4B04 MAT : Elements of Mathematics – II**

Time : 3 Hours

Max. Marks : 48

SECTION – A

All the 4 questions are **compulsory**. They carry 1 mark each.

1. Consider the relation  $R = \{(1, a), (1, b), (3, b), (3, d), (4, b)\}$  from  $X = \{1, 2, 3, 4\}$  to  $Y = \{a, b, c, d\}$ . Find the domain and range of  $R$ .
2. Evaluate  $\log_2 64$ .
3. Find the rank of a nonsingular matrix of order  $n$ .

4. Find the nullity of  $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ . (4x1=4)

SECTION – B

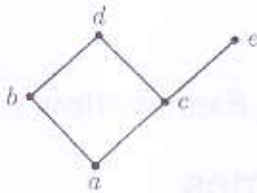
Answer **any 8** questions from among the questions 5 to 14. These questions carry 2 marks each.

5. Find all partitions of  $S = \{1, 2, 3\}$ .
6. Find the formula for the inverse of  $g(x) = \frac{2x-3}{5x-7}$ .
7. Consider the functions  $f(x) = x^2 + 3x + 1$  and  $g(x) = 2x - 3$ . Find  $f \circ g$  and  $g \circ f$ .
8. Let  $A = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24\}$  be ordered by the relation "x divides y". Draw the Hasse diagram of  $A$ .

P.T.O.



9. Let  $S = \{a, b, c, d, e\}$  be ordered as shown in the figure given below



- a) Find all subset of  $S$  in which  $c$  is a minimal element.  
 b) Find all subset of  $S$  in which  $c$  is a first element.
10. Find the equation of the chord of contact of the point  $P(h, k)$  with respect to the parabola  $y^2 = 4ax$ .
11. Find the general equation of the ellipse.
12. Let  $P\left(ct_1, \frac{c}{t_1}\right)$  and  $P\left(ct_2, \frac{c}{t_2}\right)$  be any two points on the hyperbola  $xy = c^2$ . Find the equation of the normal at  $P$ .
13. In a rectangular hyperbola, prove that  $SP \times S'P = CP^2$ , where  $P$  is any point on the hyperbola,  $S$  and  $S'$  are the foci and  $C$  is the center of the hyperbola.

14. Find the rank of  $A = \begin{bmatrix} 2 & 3 & 4 \\ 3 & 1 & 2 \\ -1 & 2 & 2 \end{bmatrix}$ . (8×2=16)

### SECTION – C

Answer **any 4** questions from among the questions **15** to **20**. These questions carry **4** marks **each**.

15. Consider the set  $Z$  of integers, define  $a \sim b$  if  $b = a^r$  for some positive integer  $r$ . Show that  $\sim$  is a partial ordering of  $Z$ .
16. Prove that a function  $f : A \rightarrow B$  is invertible if and only if  $f$  is bijective.
17. Let  $L$  be a lattice, prove the following :  
 a)  $a \wedge b = a$  if and only if  $a \vee b = b$ .  
 b) The relation  $a \leq b$  defined by  $a \wedge b = a$  or  $a \vee b = b$  is a partial order on  $L$ .



- 18. If a normal chord to the parabola subtends a right angle at the vertex, prove that it is inclined to the axis of the parabola at an angle  $\tan^{-1} \sqrt{2}$ .
- 19. Find the locus of the middle point of the line joining two points on an ellipse such that the difference of their eccentric angle is constant.

20. Reduce the matrix  $A = \begin{bmatrix} 1 & 2 & 0 & -1 \\ 3 & 4 & 1 & 2 \\ -2 & 3 & 2 & 5 \end{bmatrix}$  to its normal form and hence find the rank of A. (4×4=16)

SECTION – D

Answer **any 2** questions from among the questions **21** to **24**. These questions carry **6** marks **each**.

- 21. Consider the set Z of integers. define a relation ~ on Z by  $x \sim y$  if  $x - y$  is divisible by 5. Prove that ~ is an equivalence relation and find corresponding equivalence classes.
- 22. Let L be a finite distributive lattice. Then prove that every a in L can be written uniquely as the join of irredundant join-irreducible elements.
- 23. Find the equation of tangent and normal at a point P(h, k) on the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ .

24. Using elementary row transformations, compute the inverse of

$A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix}$  (2×6=12)

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