

**December 2017**  
**Bachelor of Computer Applications (BCA) Examination**

Vth Semester

**BCA-504 : DISCRETE MATHEMATICS AND LINEAR ALGEBRA**

Time 3 Hours]

[Max. Marks 40]

Note : Solve any two parts from each question. All questions carry equal marks.

1. (a) Define universal and existential quantifiers. Give examples of each. Explain negation of quantifiers.  
 (b) Verify the following relations using truth tables :  
     (i)  $(p \rightarrow q) \equiv (\neg p \vee q)$       (ii)  $(p \rightarrow (q \rightarrow r)) \equiv ((q \wedge q) \rightarrow r)$ .  
 (c) State and prove DeMorgan theorem for Boolean Algebra.
2. (a) Convert the function :  
 $f(x, y, z) = (xy' + xz')' + x'$  in disjunctive normal form.  
 (b) Draw the binomial net for the flow function :  
 $x'zy + xy'z + xyz' + x'y'z'$ .  
 (c) State and prove Bool's Expansion theorem.
3. (a) If A, B and C are three sets, then prove that :  
 $A \times (B \cap C) = (A \times B) \cap (A \times C)$ .  
 (b) Show that cube root's of unity form a finite Abelian group with respect to multiplication.  
 (c) Let A and B are two sets. If  $f: A \rightarrow B$  is one-one onto, then prove that  $f^{-1}: B \rightarrow A$  is also one-one onto.
4. (a) Show that the intersection of any two subspaces of a vector space  $V(F)$  is also subspace of  $V(F)$ .  
 (b) Define a set of linearly independent vectors in a vector space. Whether  $(1, 1, 2), (1, 3, 0)$  and  $(2, 0, 4)$  are linearly independent in  $\mathbb{R}^3$ .  
 (c) Show that mapping  $f: V_3(\mathbb{R}) \rightarrow V_2(\mathbb{R})$  defined as  $f(a, b, c) = (c, a + b)$  is a linear transformation.
5. (a) Find Eigen values and Eigen vectors of the matrix :  

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$
 (b) State and prove Caylay Hamilton theorem.  
 (c) Let T be the linear operator on  $\mathbb{R}^3$ , defined by :  
 $T(x_1, x_2, x_3) = (x_1 + x_2 + x_3, -x_1 - x_2 - 4x_3, 2x_1 - x_3)$ .  
 What is matrix of T in the order Basis :  
 $B = \{(1, 1, 1), (0, 1, 1), (1, 0, 1)\}$ .