Roll No. ....

E–3890

B. C. A. (Part I) EXAMINATION, 2021

(New Course)

Paper First

DISCRETE MATHEMATICS

(BCA–101)

Time : Three Hours] [*Maximum Marks : 80*

[*Minimum Pass Marks : 27*

Note : All questions are compulsory. Attempt any *two* parts from each question. All questions carry equal marks.

Unit—I

1. (a) Construct truth table for the following function and check whether it is a tautology or contradiction :

$$\left[\; p \wedge q \;\;\vee\;\; q \wedge r \;\;\vee\;\; r \wedge p \;\right]$$

$$\Leftrightarrow \left[\; p \vee q \;\;\wedge\;\; q \vee r \;\;\wedge\;\; r \vee p \;\right]$$

(b) If $p \equiv$ Ram is beautiful, $q \equiv$ Ram is mixable, $r \equiv$ His friends like Ram, then write the following statements in language :

(i) $p \Rightarrow q \;\;\vee\;\; p \Rightarrow r$

(ii) $p \Rightarrow \;\; q \vee r$

Examine, are the above statements equivalent.

P. T. O.

(c) Test the validity of the following argument :

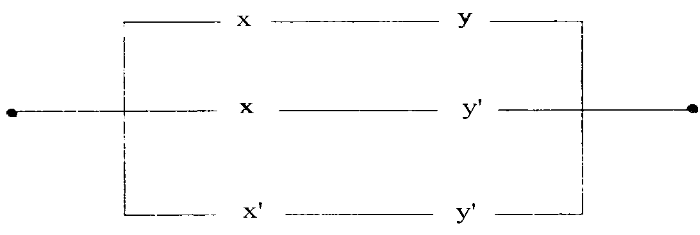
"If Ashok wins then Ram will be happy. If Kamal wins Raju will be happy. Either Ashok will win or Kamal will win. However if Ashok wins, Raju will not be happy and if Kamal wins Ram will not be happy. So Ram will be happy if and only if Raju is not happy."

Unit—II

2. (a) Show that the identity element in a Boolean algebra are unique.

(b) In a Boolean algebra B, prove that $x.y \geq z$ if and only if $x \geq z$ and $y \geq z$, where $x, y, z \in B$.

(c) Draw a simpler circuit for the following diagram and verify the equivalent circuits by truth tables :



Unit—III

3. (a) Show that complete canonical form in n variables is always equal to 1. Explain it by giving examples in 2 and 3 variables.

(b) Change the following Boolean function to conjunctive normal form :

$$f \quad x, y, z, t \quad = \quad x'y + xyz' + xy'z + x'y'z't + t' \; '$$

(c) Design a 4-terminal circuit which gives the real forms to the following three functions :

$$f = a \;\; b + cd \quad x + y$$

$$g = a \;\; bc + cd$$

$$h = a \;\; bc' + b'cd$$

Unit—IV

4. (a) If A = {2, 4, 6}, B = {1, 4, 5, 6}, then find out the relation from A to B defined by “is less than or equal to”. Find out the domain and range of the relation.

(b) If R and S be an equivalence relation in the set X, then prove that $R \cap S$ is an equivalence relation in X.

(c) If $f : A \rightarrow B$ and $g : B \rightarrow C$ be two one-one onto maps, then show that $g \circ f : A \rightarrow C$ is also one-one onto and $g \circ f \;^{-1} = f^{-1} \circ g^{-1}$.

Unit—V

5. (a) Show that a connected planar graph with n vertices and e edges has $e - n + 2$ regions.

(b) Show that every tree with two or more vertices is 2-chromatic.

(c) Determine the minimal spanning tree for the graph given below :