Roll No......................

Total No. of Section : 03
Total No. of Printed Pages : 03

Code No. : B-401(A)

Annual Examination - 2017

BCA-I

(BCA-101)

Paper - I

DISCRETE MATHEMATICS

Max.Marks : 50
Time : 3 Hrs. **Min Marks : 20**

Note : Section 'A' is very short answer type, containing 10 questions, is compulsory. Section 'B' consists of short answer type questions and Section 'C' consists of long answer type questions. Section 'A' has to be solved first.

(Section-'A')

(Very short answer type questions. Answer in one or two lines.) (1x10=10)

Q.1 Define logical equivalence.
Q.2 What is open statement?
Q.3 What is principle of duality?
Q.4 Write involution law.
Q.5 What is conjunctive normal form?
Q.6 Define Boolean function.
Q.7 What is equivalence relation?
Q.8 Define composition of mapping.
Q.9 What is null graph?
Q.10 Define spaning tree.

(Section-'B')

Short answer type questions (3x5=15)

Q.1 Prove that $\sim B \wedge (A \Rightarrow B) \Rightarrow \sim A$, is a tautology.

P.T.O.

OR

Write a negation of the following :

i) $\forall x(x \neq 1, x \neq 2)$

ii) $\forall x(x \neq 0) \Rightarrow (x^2 > 0)$

iii) $\exists x(x^2 = 1 \text{ and } x^2 - 2x + 3 = 0)$

Q.2 For any element a of Boolean algebra B, prove that $a+1=1$.

OR

In any Boolean algebra prove that :

$$a \leq b\ ,\ a \leq c \Rightarrow a \leq b \cdot c$$

Q.3 Draw a simple circuit for switching function.

$$F(x,y) = x \cdot y' + x \cdot y$$

OR

Prove that the complete conjunctive normal form in two variables is identically zero.

Q.4 Draw a tree-net for the function $a \cdot b' + a' \cdot b + a' \cdot b' + a \cdot b$.

OR

Write types of Boolean function with example.

Q.5 Express the following functions in disjunctive normal form in the smallest possible number of variables :

$$f(x,y,z) = [(x+y')\ (x \cdot y'z)']'$$

OR

Draw the logic circuit for the following Boolean expression :

$$(x+y)z(x'+y'+z')$$

(Section-'C')

Long answer type questions (5x5=25)

Q.1 Prove that : $[(P \wedge Q) \wedge R] = [P \wedge (Q \wedge R)]$ is a tautology.

OR

Prove that following statement is a contradiction :

$$[(P \wedge r) \vee (q \wedge \sim r)] \Leftrightarrow [(\sim P \wedge r) \vee (\sim q \wedge \sim r)]$$

Q.2 Draw the simple circuit for the following switching function :

$$x.y.z + (x+y).(x+z)$$

OR

In a Boolean algebra B show that if $a+b=a+c$ and $a \cdot b = a \cdot c$ them $b=c$.

Q.3 State and prove Boole's expansion theorem.

OR

Convert the following function in conjunctive normal form:

$$f(x,y,z) = (x+y+z) \cdot (x \cdot y + x' \cdot z)'$$

Q.4 If I is the set of non-zero integers and a relation defined by xRy if $x^y = y^x$ where $x, y \in I$, then prove that R is an equivalence relation.

OR

If a mapping $f: Q \to Q$ is defined by $f(x) = 2x+3, x \in Q$, where Q is the set of rational numbers. Then prove that the mapping is one-one onto. Also find f^{-1}.

Q.5 Prove that a tree with n vertices has $(n-1)$ edges.

OR

If a graph $G=(V,E)$ is defined by :

$$V = \{v_1, v_2, v_3\}, E = \{(v_1, v_2), (v_2, v_3), (v_1, v_3)\}$$

$$|V| = 3, |E| = 3$$

then find the adjacency matrices and the incidence of the graph G.

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