DISCRETE MATHEMATICS - 2013

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

UNIT - 1

1. (a) Prove that each of the following statements is a contradiction :

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

(b) Explain the Algebra of Proposition.

(c) Write the following sentences into symbols :

(i) Two non-parallel coplaner straight lines have a common point.

(ii) If there is no prize, then a person does not purchase a ticket.

UNIT - 2

2. (a) Simplify the following by using Boolean algebra :

(i) $[a + (a' \cdot b)] \cdot [a' + (a \cdot b)]$

(ii) $a \cdot b + [(a + b') \cdot b]'$

(b) Define partial order relation. Prove that the order relation $\leq$ is partial order relation in a Boolean algebra.

(c) Draw a simplified circuit of the expression :

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

UNIT - 3

3. (a) Explain the Boole's Expansion theorem.

(b) Express the following function in conjunctive normal form : $f(x, y, z) = (xy' + xz)' + x'$

(c) Design a 3-terminal circuit which gives the real forms to the following both functions :

$$f = xzw + y'zw$$
$$g = zxw + y'zw + x'y'z$$

(3)

UNIT - 4

4. (a) Let I be the set of non-zero integers and a relation R be defined by xRy if $x^y - y^x$, where $x, y \in I$. Is the relation R an equivalence relation ?

(b) If X, Y, Z, W are four sets and f, g, h be three mappings given by :

$$f : X \to Y,\ g : Y \to Z,\ h : Z \to X$$

then prove that $(h \circ g) \circ f = h \circ (g \circ f)$.

(c) If $f : A \to B$ is one-one and onto, then prove that $f^{-1} : B \to A$ is also one-one and onto.

UNIT - 5

5. (a) Show that the sum of the degrees of all vertices in a graph G is equal to twice the number of in a graph G is equal to twice the number of edges in G.

(b) 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 matrix and the incidence matrix of the graph G.

(c) Explain the planar graphs.