2017

(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper No. : BCA-202

[Mathematics—II (Discrete Mathematics)]

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* In a survey, it is found that 20 people like product *A*, 30 people like product *B* and 28 like product *C*. If 15 people like products *A* and *B*; 16 people like products *B* and *C*; 12 people like products *C* and A and 8 people like all the three products, find—

(i) how many people are surveyed in all;

(ii) how many like product B only. 5

(b) In a Boolean algebra B, prove that

$$(x+y)' = x' \cdot y' \text{ for all } x, y \in B. \quad 5$$

Or

(c) Let $\langle L, \leq \rangle$ be a lattice in which $*$ and $\oplus$ denote the operation of meet and join respectively. For any $a, b \in L$, show that

$$a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b \quad 5$$

(d) In Boolean algebra $B \forall\, x, y, z \in B$, prove that

$$x + x' \cdot (x+y) + y \cdot z = x + y \quad 5$$

2. *(a)* Without truth table, show that

$$(P \wedge Q) \vee (\urcorner P \vee (\urcorner P \vee Q)) \Leftrightarrow (\urcorner P \vee Q) \quad 5$$

(b) Obtain the principal conjunctive normal form of the formula

$$(\neg P \to R) \wedge (Q \rightleftarrows P). \qquad 5$$

Or

(c) By using the truth table, prove that

$$(P \to Q) \wedge (Q \to R) \Rightarrow P \to R \qquad 5$$

(d) Obtain the principal disjunctive normal form of

$$P \to ((P \to Q) \wedge \neg(\neg Q \vee \neg P)) \qquad 5$$

3. *(a)* A committee of 5 is to be formed out of 6 men and 4 ladies. In how many ways can this be done, when—

(i) at least 2 ladies are included;

(ii) at most 2 ladies are included? 5

(b) How many numbers are there between 100 and 1000, which have exactly one of their digits as 8? 5

Or

(c) Find the 10th term in the expansion of

$$\left(\frac{a}{b} - \frac{2b}{a^2}\right)^{15} \qquad 5$$

(d) The 2nd, 3rd and 4th terms in the expansion of $(x+y)^n$ are 240, 720 and 1080 respectively. Find the values of x, y and n. 5

4. (a) Show that the set $G = \{1, \omega, \omega^2\}$, where ω is an imaginary cube root of unity, is a group with respect to multiplication. 5

(b) Prove that the set $G = \{0, 1, 2, 3, 4, 5\}$ is a finite Abelian group of order 6 with respect to addition modulo 6. 5

Or

(c) If H_1 and H_2 are two subgroups of a group G, then show that $H_1 \cap H_2$ is also a subgroup of G. 5

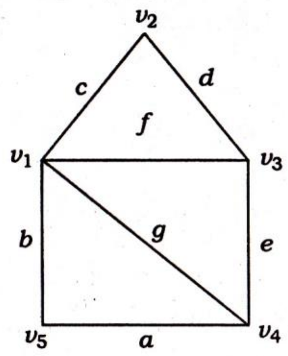
(d) State and prove Lagrange's theorem. 5

5. (a) Define bipartite graphs. Draw the graph of $k_{2,4}$; $k_{3,3}$ and $k_{3,5}$. 2+3=5

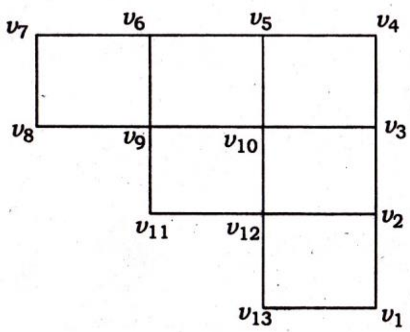
(b) Show that in any digraph, the sum of all in-degrees is equal to the sum of all out-degrees and each sum being equal to the number of edges. 5

Or

(c) Write the adjacency and incidence matrices for the following graph : 5



(d) Define Hamiltonian circuits. Check whether the following graph has Hamiltonian circuit or not : 5



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