

B.C.C.A.-II (CBCS Pattern) Semester - IV  
**UBCCAT404 - Paper-IV : Mathematics**

P. Pages : 2

Time : Three Hours



**GUG/S/23/12048**

Max. Marks : 40

- Notes :
1. All questions are compulsory and carry equal marks.
  2. Draw neat and labelled diagram wherever necessary.
  3. Avoid vague answers and write answer relevant and specific to questions only.

**Either:**

1. a) Define set & explain different operations on set. 4
- b) Let A is a set of  $A = \{a, b, c, d, e\}$ ,  $B = \{a, b, e, g, h\}$ ,  $C = \{b, d, e, g, h, k, m, n\}$  then verify 4  
 $|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |B \cap C| - |A \cap C| + |A \cap B \cap C|$

**OR**

- c) Prove the statement is true by using mathematical induction. 4  
$$1 + a + a^2 + \dots + a^{n-1} = \frac{a^n - 1}{a - 1}$$
- d) If A, B, C are sets, then prove that 4
- i)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- ii)  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

**Either:**

2. a) Construct the truth table for the following. 4
- i)  $(P \vee Q)$
- ii)  $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R)$

- b) Explain the form tautology and contradiction in the context of truth table. 4

**OR**

- c) Obtain the principal disjunctive normal form of: 4  
 $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$
- d) Given the truth values of P and Q as T and those of R and S as F. 4  
Find truth value of following:
- i)  $(P \wedge (Q \wedge R)) \vee \neg ((P \vee Q) \wedge (R \vee S))$
- ii)  $(\neg(P \wedge Q) \vee \neg R) \vee (((\neg P \wedge Q) \vee \neg R) \vee S)$

**Either:**

3. a) Let  $A = \{1, 2, 3, 4\}$  and  $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (2, 3), (2, 4), (3, 4), (4, 1)\}$  4  
Draw diagram and  $M_R$  relation.
- b) Determine the value of following: 4
- i)  ${}^4P_2$
- ii)  ${}^9P_3$

**OR**

- c) How many distinguishable permutation of the letter in the word. 4
- i) BOOLEAN
- ii) REQUIREMENTS
- d) To prove 4  
 $n \times p(n-1, n-1) = p(n, n)$

**Either:**

4. a) Explain the properties of group in brief. 4
- b) Prove the left cancellation law. 4  
i.e.  $ab = ac \Rightarrow b = c \quad \forall a, b, c \in G$   
(left cancellation law)

**OR**

- c) Consider the binary operation  $*$  on  $\theta$ , the set of relational number defined by 4  
 $a * b = \frac{ab}{2} \quad \forall a, b \in \theta$ . Determine whether  $*$  is (i) associative (ii) Commutative.
- d) Define Semigroup, 4  
Let  $(A, *)$  be semigroup. Show that for  $a, b, c$  in  $A$  if  $a * c = c * a$  and  $b * c = c * b$ .  
Then  $(a * b) * c = c * (a * b)$ .

5. Attempt all the questions.
- a) To find equivalence of statement 2  
 $p \rightarrow q \equiv (\sim p) \vee q$
- b) Determine the value of  $n$  if 2  
 ${}^nC_{n-2} = 10$
- c) What is Normal Forms? Explain it. 2
- d) Write short note on Abelian group. 2

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