UBCCAT404 - Paper-IV : Mathematics

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Notes : 1. All questions are compulsory and carry equal marks.
2. Draw neat and labelled diagram and use supporting data wherever necessary.
3. Avoid vague answer and write specific answer related to questions.

Either:

1. a) What is Set? Explain types of Set.   **4**

b) If A, B and C are three sets, then prove that $A \cup (B \cup C) = (A \cup B) \cup C$.   **4**

OR

c) If $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 1 & -2 \end{bmatrix}_{2 \times 3}$ & $B = \begin{bmatrix} -3 & 2 \\ 4 & 1 \\ 5 & -2 \end{bmatrix}_{3 \times 2}$ Find $A \times B$.   **4**

d) Construct the truth table for,   **4**

i) $(A \oplus B) \oplus C$

ii) $(A \uparrow B) \uparrow C$

Either:

2. a) Explain the following with example.   **4**

i) Duality

ii) Equivalence of formula.

b) Construct the truth table of   **4**
i) $(P \vee Q) \vee \neg P$
ii) $\neg(\neg P \wedge \neg Q)$

OR

c) Show that following statement is of contingency   **4**
$(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)$

d) Prove the following statement,   **4**
$(P \rightarrow Q) \leftrightarrow (\neg P \rightarrow \neg Q)$

Either:

3. a) Let $A = \{1,2,3,4\} \& R = \{(1,1)(1,2)(2,1)(2,2)(2,3)(2,4)(3,4)(4,1)\}$ Draw diagraph and M_R of relation. **4**

b) To prove:- **4**

$$p(n,r) = p(n-1,r) + r \cdot p(n-1,r-1).$$

<div align="center">OR</div>

c) There are 4 blue, 3 red and 2 black pens in a box. These are drawn one by one. Determine all the different permutations. **4**

d) Determine the value of the following **4**
  i) P(15, 3)
  ii) $^{52}P_4$

Either:

4. a) State and explain the properties of binary operations. **4**

b) Let T be the set of all even integer. Show that the semigroups (Z, +) and (T, +) are isomorphic. **4**

<div align="center">OR</div>

c) Prove the $(ab)^{-1} = b^{-1}a^{-1}$ for all, $a, b \in G$. **4**

d) If a, b are element in G the $\dfrac{ab}{2}$ is non-zero real number. **4**

$$a * b = \frac{ab}{4}$$

Show that $(G, *)$ is an abelian group.

5. Solve all questions.

a) Draw the Venn diagram for **2**
   $A \cup B, A \cap B$

b) Prove that, **2**
   $$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$$

c) Determine the value of n if **2**
   $$4 \times {}^n P_3 = {}^{n+1}P_3$$

d) Define Abelian group. **2**

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