

B.C.A. - I (NEP Pattern) Semester-I
CC101 Core Paper-I - Mathematics Foundations to Computer Science

P. Pages : 2

Time : Three Hours



GUG/W/24/16187

Max. Marks : 60

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

Either:

1. a) What is Set? Explain it's representation and different types with example of each. 6
- b) Prove that: 6
- 1) $(A \cap B) \times (C \cap D) = (A \times C) \cap (B \times D)$
 - 2) $|A \cup B| = |A| + |B| - |A \cap B|$

OR

- c) Make a truth table for statement: 6
- 1) $(p \wedge q) \vee (\sim p)$
 - 2) $\sim (p \vee q) \wedge r$
- d) Prove that the statement is true by using mathematical induction. 6
- $$1 + 3 + 5 + \dots + 2n - 1 = n^2$$

Either:

2. a) What is Biconditional Statement? Construct truth table for 6
- $$\neg(P \wedge Q) \Leftrightarrow (\neg P \vee \neg Q)$$
- b) Give the truth values of P and Q as T and these of R and S as F. Find the truth value of the following: 6
- 1) $(P \Leftrightarrow R) \wedge (\neg Q \rightarrow S)$
 - 2) $(P \vee (Q \rightarrow (R \wedge \neg P))) \Leftrightarrow (Q \vee \neg S)$

OR

- c) Construct the truth table for 6
- $$(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)$$
- d) Obtain the principal conjunctive normal form of the formula S given by 6
- $$(\neg P \rightarrow R) \wedge (Q \Leftrightarrow P)$$

Either:

3. a) Determine the value of the following: 6
- i) ${}^{20}P_3$ ii) 9P_3
- iii) 5P_3
- b) How many variable names of 8 letters can be formed from the letters a, b, c, d, e, f, g, h, i if no letter is repeated. 6

OR

- c) 6
- Let $A = \{1, 2, 3, 4\}$ and $M_R = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$ give the relation R defined of A and its digraph.
- d) Let R and S be two relation from A to B. Show that: 6
- $$(R \cup S)^{-1} = R^{-1} \cap S^{-1}$$

Either:

4. a) Consider the binary operation * and Q, the set of rational number defined by: 6
- $$a * b = \frac{ab}{2} \quad \forall a, b \in Q$$
- Determine whether * is
- 1) Associative
- 2) Commutative
- b) Let $(s, *)$ be a given semigroup there exists a homomorphism $g : s \rightarrow s^3$, where $(s^3, *)$ is a semigroup of function from s to under the operation of left composition. 6

OR

- c) Show that if G is an abelian group then every subgroup of G is a normal subgroup. 6
- d) If H and K are subgroup of G, show that $H \cap K$ is a subgroup of G. 6

5. Attempt all the questions below.

- a) If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, show that $A^2 = I_2$. 3
- b) What is mathematical logic? Explain it's characteristics in short. 3
- c) Write short note on pigeonhole principle. 3
- d) Show that $(a^{-1})^{-1} = a$ for all $a \in G$, where G is a group and a^{-1} is an inverse of a. 3
