(DMCA108)

Total No. of Questions :18] **[Total No. of Pages : 02**

M.C.A. DEGREE EXAMINATION, MAY– 2018

First Year

DISCRETE MATHEMATICS

Time :3 Hours **Maximum Marks :70**

SECTION - A

Answer any three of the following questions. **(3 x 15 = 45)**

Q1) a) Prove that, for any three propositions p, q, r, the compound proposition $[(p \to q) \wedge (q \to r)] \to (p \to r)$ is tautology.

b) Obtain principle disjunctive normal form of the following. $P \to \{(p \to q) \wedge \neg(\neg q \vee \neg q)\}$

Q2) a) Prove that $f^{-1} \circ g^{-1} = (g \circ f)^{-1}$, where $f : Q \to Q$ such that $f(x) = 2x$ and $g : Q \to Q$ such that g(x) = x+2 are two functions.

b) On the set of integers, the relation R is defined by "aRb" if and only if "($a - b$) is even integer". Show that R is an equivalence relation.

Q3) Solve the following recurrence relations:

i) $a_{n+1} - 2a_n = 2^n, n \geq 0, a_0 = 1$

ii) $a_n = 3a_{n-1} - 2a_{n-2}$ for $n \geq 2$

Q4) a) A non-empty subset S of G is a sub group of (G, *) iff for any pair of elements $a, b \in$ S.

b) Let G be the set of all nonzero real numbers, for $a*b = ab/2$, show that (G,*) is Abelian group.

Q5) What is partial order and partial order set? Draw Hasse diagram for poset (P(A), $\subset$) where A = {1, 2, 3, 4} is the power set of A.

SECTION - B

Answer any five of the following questions. **(5 x 4 = 20)**

Q6) Prove that the logical equivalence of $[p \wedge (p \to q) \wedge r] \equiv [(p \vee q) \to r]$.

Q7) Show that $\forall x(P(x) \vee Q(x)) \equiv \forall x P(x) \wedge \forall x Q(x)$.

Q8) In how many ways can 4 mathematics books, 3 history books, 3 chemistry books and 2 sociology books be arranged on the shelf so that all books of the same subject are together?

Q9) What are the reflexive, symmetric and transitive relations?

Q10) Let $f(x) = x+2$, $g(x) = x-2$, $h(x) = 3x$ for $x \in$ R where R is set of real numbers. Find gof, hof.

Q11) Show that the semi group (Z, +) and (E, -) where E is the set of even integers are isomorphic.

Q12) Solve the linear recurrence relation: $a_0 = 4a_{n-1} + 5a_{n-2}$ with $a_1 = 2$, $a_2 = 6$.

Q13) Let G be group and let a, b, $c \in$ G, then show that:

i) $ab=bc \Rightarrow b=c$

ii) $(ab)^{-1} = b^{-1}a^{-1}$

SECTION - C

Answer all of the following questions. **(5 x 1 = 5)**

Q14) Define monoid.

Q15) Define Lattice.

Q16) Define binary relation.

Q17) Define disjunctive normal form.

Q18) What is generating function.

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