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B.Sc.(IT) (2013 & 2014) (Sem.–2)

MATHEMATICS – II (DISCRETE)

Subject Code : BS-104

Paper ID : [B0406]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying TEN marks each and students has to attempt any FOUR questions.

SECTION-A

1. Write briefly :

a) Find number of relations from a set A = {a, b} to B = {1, 2, 3, 4}.

b) Let A = {1, 3, 4, 6, 8, 9} and R be a relation "x divides y" on A. Draw its Digraph.

c) Is inverse of a function $f(x) = 2^x, x > 0$ exist? Give specific answer.

d) State Principle of Mathematical Induction.

e) Prove that $\sum_{r=0}^{n} (-1)^r C(n,r) = 2^n$.

f) Find the generating function of the sequence < 0, 0, 2, 2, 2, … >.

g) Show that $p \leftrightarrow q \equiv (p \vee q) \rightarrow (p \wedge q)$ using laws of algebra.

h) Determine all the Boolean sub-algebra of Boolean algebra D_{30}.

i) Check whether $\neg (p \rightarrow q) \vee (\neg p \vee (p \wedge q))$ is a tautology or contradiction.

j) Find the dual of Boolean equation $(a * 1) * (0 + a') = 0$.

SECTION-B

2. Let R be a relation on N × N defined by (a, b) R $(c, d) \Leftrightarrow ad\,(b + c) = bc\,(a + d)$, where N denote the set of all natural numbers. Show that R is an equivalence relation on N × N.

3. Let $f : X \to Y$ and $g : Y \to Z$ and f, g be both one-one and onto. Show that $g \circ f : X \to Z$ is invertible and $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$.

4. Show that $(11)^{n+2} + (12)^{2n+1}$ is divisible by 133 by mathematical induction for any integer n.

5. Solve the recurrence relation $a_r - 6a_{r-1} + 8a_{r-2} = r.4^r$, $a_0 = 8$ and $a_1 = 22$.

6. a) State and prove Disjunctive syllogism.

   b) Check the validity of the following argument: "If I try hard and I have a talent then I will become an engineer. If I became an engineer then I will be happy. Therefore, if I will not be happy then I did not try hard or I do not have talent".

7. a) State and prove De-Morgan's Laws in a Boolean Algebra.

   b) Simplify the following Boolean function and realize the logic diagram of the reduced function with the help of NAND gate only

$$F(A,B,C,D) = \overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,C\,\overline{D} + A\,\overline{B}\,\overline{C}\,\overline{D} + A\,\overline{B}\,\overline{C}\,D + A\,\overline{B}\,C\,\overline{D} + A\,\overline{B}\,C\,D + A\,B\,C\,\overline{D} + ABCD$$