(Please write your Exam Roll No.) Exam Roll No. 01250404415

END TERM EXAMINATION

FIRST SEMESTER [MCA] DECEMBER 2015- JANUARY 2016

Paper Code: MCA 105	Subject: Discrete Mathematics (Batch: 2015)

Time : 3 Hours Maximum Marks :75

Note: Attempt any five questions including Q. No. 1 which is compulsory. Select one question from each unit.

Q1. a) Show that a set of n elements can have 2^n subsets. **(2.5x10=25)**

b) Define binary relation. How many binary relations are there on a set A with n elements?

c) How many ways are there to arrange 7- sign and 5+ sing, such that no two +sign are together?

d) The set P ({a,b,c,}) is partially ordered with respect to the subset relation. Find a chain of length 3 in P.

e) Show that D_{20} is not a finite Boolean algebra with the partial order of divisibility.

f) Find the solution of recurrent relation $a_n=3a_{n+1}$ where $a_0=1$.

g) What are applications of number theory in computer science?

h) Show that any subgroup of a cyclic group is cyclic.

i) Giving graphical representation discuss seven bridge problem. Was it possible for a citizen to make a tour of the city and across each bridge exactly twice? Give reasons.

j) Define Hamiltonian graph with example.

Unit-I

Q2. a) Let Z be the set of all integers and R be a relation defined on Z such that for any a,b $\in$ Z, aRb if and only if ab$\geq$ 0. Is R an equivalence relation? **(3.5)**

b) Find the number of integers between 1 and 100 that are divisible by any of the integer 2,3,5,7. **(4)**

c) Show by mathematical induction

$$\sum_{i}^{n} i = \frac{n(n+1)}{2}, \forall n \in N.$$ **(5)**

Q3. a) Without using truth table, prove the following: **(6.25)**

$(\neg p \vee q) \wedge (p \wedge (p \wedge q)) \equiv (p \wedge q)$

b) Define function. Find the inverse of function $f(x)=\frac{1}{x-1}, x \neq 1.$ **(6.25)**

Unit-II

Q4. a) Let (L, $\leq$) be a bounded distributive lattice with 1 and 0 as unit and zero elements of L respectively. **(6.25)**

i) Prove the DeMorgan's Law.

ii) Show that if the complement of an element in L exists then it is unique.

b) Simplify y= $\sum$ m(0, 1,2,3,4,6,8,9,10,11,12,14) using K-map. **(6.25)**

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P1/2

Q5. a) Let L_1 be the lattice D_6(divisor of 6) = {1,2,3,6} and let L_2 be the lattice $(P(S), \subseteq)$ where S= {a, b}. Show that two lattices are isomorphic. **(6.25)**

b) Minimize the Boolean expression $f(x,y,z,w)= \sum (0, 3,4,5, 7)$ and $d(x,y,z, w) = \sum (8,9,10,11,12,13,14,15)$. **(6.25)**

Unit-III

Q6. a) Explain Euclidean algorithm to find the gcd of two numbers by taking example. **(6.25)**

b) Find the code words generated by the parity-check matrix given below. **(6.25)**

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$, when the encoding function is $E: B^3 \rightarrow B^6$.

Q7. a) Let (G, *) be a group. Let $H = \{ a: a \in G \text{ and } a*b= b*a \text{ for all } b \in G\}$. Show that H is a normal subgroup. **(6.25)**

b) Let (G, .) be a group. Let (H, .) be a subgroup of (G,.). Show that $G=H \cup Ha \cup Hb$, where $a,b \in G$. **(6.25)**

Unit-IV

Q8. a) Differentiate between **(7.5)**

i) Graph and Tree
ii) Sub graphs and isomorphic graph
iii) Connected and complete graph

b) Let G=(V,E) be an undirected graph with edges then show that $2e=\sum \deg(v), v \in V$. **(5)**

Q9. a) Explain inorder, preorder and postorder tree traversals with the help of an example. **(7.5)**

b) Show that a graph is two colorable if and only if it is a bipartite graph. **(5)**

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