BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE
BRANCH: CSE

SEMESTER : III
SESSION : MO/16

SUBJECT: CS4101 DISCRETE MATHEMATICAL STRUCTURE

TIME: 03:00 Hours

FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Show that $(\sim p \wedge (p \vee q)) \Rightarrow q$ is a tautology. [2]

(b) Using Tautologies prove that $(\sim (p \wedge \sim q) \wedge (\sim q \vee r) \wedge (\sim r)) \Rightarrow \sim p$ [4]

(c) Show that $\exists x (p(x) \Rightarrow q(x)) \equiv \forall x\, p(x) \Rightarrow \exists x\, q(x)$ [6]

Q.2(a) State if the argument given below is valid or not [2]

I will become famous or I will not become a writer
I will become a writer

I will become famous

(b) Say $p(x,y) \equiv x.y = 0$ $\quad$ *where x, y are real numbers* [4]

Check if the following statements are true or false

$a.\ \forall x \forall y\, p(x,y) \quad b.\ \forall x\, \exists y\ p(x,y) \quad c. \exists x\, \exists y\ p(x,y)$

(c) If a sequence a_n satisfies $a_{n+1} = \dfrac{a_n}{a_n + 1}$. Show using Mathematical Induction $a_n = \dfrac{a_0}{na_0 + 1}$ [6]

Q.3(a) Let A = {1,2,3,4}. Determine whether the relation R on set A is reflexive, irreflexive, symmetric, asymmetric, antisymmetric, or transitive. [2]
R = {(1,1), (1,3), (3,1), (1,2), (3,3),(4,4)}. Justify your answer.

(b) Let A be a given finite set and P(A) its power set. Let $\subseteq$ be the inclusion relation (subset relation) on P(A) i.e. (P(A), $\subseteq$) is a poset. Draw the Hasse diagram for [4]
a. A= {1} b. A = {1,2} c. A = {1,2,3} .

(c) Let S = (1,2,3,4) and $A = S \times S$. Define the following relation *R* on *A* : (a,b) *R* (c,d) iff a+b = c+d. [6]
Show that
a. *R* is and Equivalence relation.
b. Compute $\dfrac{A}{R}$.

Q.4(a) Define transitive closure of a relation R on set A. [2]

(b) Show that the function g from N×N to N given as g(x,y) = xy. Check whether the function is one-one and/or onto with proper justification. [4]

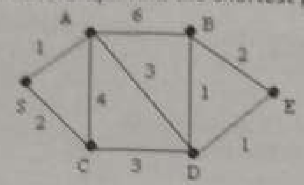
(c) Let A = {1,2,3,4,5} and relation *R* on set A be given as $M_R = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$. Find $\dfrac{A}{R^\infty}$. [6]

PTO

Q.5(a) Define undirected Tree. [2]

(b) Define Hamiltonian Path and circuit in Graph using suitable example. [4]

(c) In the Graph find the shortest path, using suitable algorithm, between S and E. [6]



Q.6(a) Define rooted tree. [2]

(b) Explain pre-order tree traversing. Design a binary on which if pre-order traversing is run the output string is CATSANDDOGS. [4]

(c) Find the minimum spanning tree using suitable algorithm. [6]

Q.7(a) Does the following table define a semi-group or a monoid? [2]

*	a	b	c
a	a	c	b
b	c	b	a
c	b	a	c

(b) Prove that in a Group $< G, \circ >$ [4]

a. Inverse of every element is unique.

b. $(a \circ b)^{-1} = b^{-1} o\, a^{-1} \quad \forall a, b \in G$

(c) [6]

Let $H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ be parity check matrix. Determine the (3,6) group code function $e_H : B^3 \to B^6$. Find the minimum distance of e_H and how many errors e_H can detect.

*****02-12-2016 E******