Course: B. Tech in Computer Science and Engg | Sem: III

Subject Name: Discrete Mathematics | Subject Code: BTCOC302

Date: 03/12/2018 | Max Marks: 60 | Duration: 3 Hrs.

Instructions to the Students:
1. *Solve ANY FIVE questions out of the following.*
2. *Use of non-programmable scientific calculators is allowed.*
3. *Assume suitable data wherever necessary and mention it clearly.*

Marks

Q. 1 Solve Any Three of the following.

A) Let p and q be the propositions "Swimming at the New Jersey shore is allowed" and "Sharks have been spotted near the shore" respectively. Express each of these compound propositions as an English sentence.
   a) $\neg q$ b) $p \rightarrow \neg q$ c) $p \leftrightarrow \neg q$ d) $\neg p \vee q$ | 4M

B) Explain with example, notations used and mathematical expression to describe the following terms.
   i) Membership   ii) Subset   iii) Equality of two sets   iv) Union | 4 M

C) Use mathematical induction to show that $1+5+9+...+(4n-3) = n(2n-1)$, $\forall n \geq 1$, $n \in Z$ | 4M

D) Explain Universal quantifiers and Existential quantifiers with example. What is De Morgan's law for quantifiers? | 4M

Q.2 Solve the following.

A) Check whether the relation R defined in the set $\{1, 2, 3, 4, 5, 6\}$ is $R = \{ (a, b) : b = a+1 \}$ is reflexive, symmetric or transitive. Justify your answer. Find the relation Matrix. | 6 M

B) Explain surjective, injective, bijective and inverse function each with example. | 6M

Q. 3 Solve Any three of the following.

A) Explain the pigeonhole principle with example. | 4M

B) Find how many symbol codes can be formed if the first two symbols are letters and the next three are digits but no symbol is repeated? | 4M

C) What is the expansion of $(3x + y)^4$? | 4M

D) Determine the sequence $\{ a_n \}$ where $a_n = 3n$ for every non-negative integer, n is a solution of the recurrence relation $a_n = 2a_{n-1} - a_{n-2}$ for n = 2, 3, 4, ... | 4M
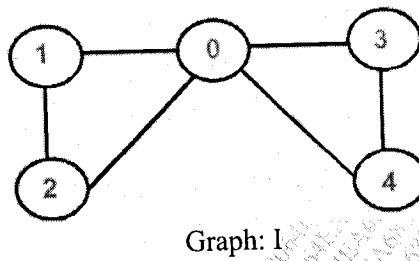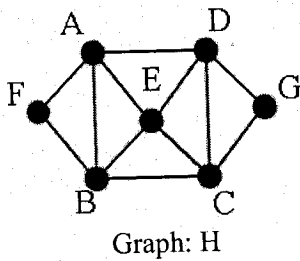
Q.4 Solve the following.

**A)** Define Euler graph and Hamiltonian Graph.
i)For a given graph G :
   (a) Find a Hamiltonian path that begins at A and ends at E.
   (b) Find a Hamiltonian circuit that starts at A and ends with the pair of vertices E, A.
   (c) Find a Hamiltonian path that begins at F and ends at G.
ii) For a given graph I find Eulerian path and Eulerian cycle. | 6M

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Graph: H

Graph: I

B) Find the shortest path in the given graph using Dijkstra shortest path algorithm. **6M**
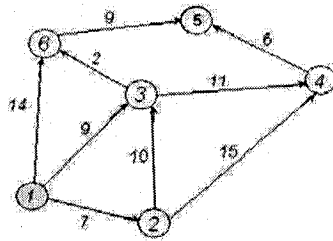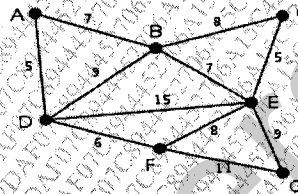

Q. 5 Solve Any three of the following.

A) Show that a tree with n vertices has n-1 edges. **4M**
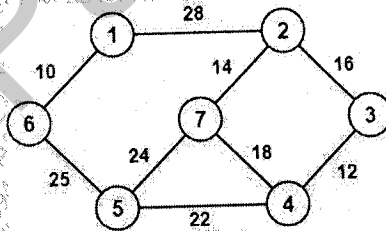
B) Find minimum spanning tree for the given graph using Prim's algorithm? **4M**

C) Define the following terms with reference to tree with example. **4M**
i)Level and Height of a tree   ii)M-ary Tree   iii) Eccentricity of a vertex

D) Construct the minimum spanning tree (MST) for the given graph using Kruskal's **4M**
Algorithm.

Q. 6 Solve the following.

A) Define the following terms. **6M**
i)Algebraic Structures   ii) Semi Groups   iii) Monoids   iv) Ring
v) Field   vi) Group

B) For each of the following, determine whether the binary operation * is commutative or **6M**
associative?
i)   N is the set of natural numbers and $a * b = a + b + 2$ for a, b $\in$ N
ii)   On N where $a * b = \min(a, b+2)$
iii)   On R where $a * b = a^b$

*** End ***