JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, July/August - 2021
DISCRETE MATHEMATICS
(Common to CSE, IT)

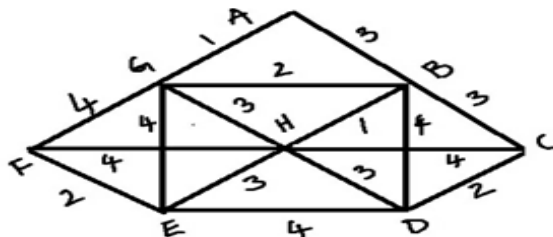**Time: 3 Hours**   **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Give a direct proof and an indirect proof, "If n is an odd integer, then $(n + 9)$ is an even integer".
  b) Show the following statement is a tautology.
      $(\neg P \wedge (\neg P \wedge Q)) \rightarrow \neg Q$ [7+8]

2.a) Let $X = \{1,2,3,4,5,6,7\}$ and $R = \{(x,y) | x - y \text{ is divisible by } 3\}$ in X. Show that R is an equivalence relation.
  b) Let the function $f: N \rightarrow N$ and $g: Z \rightarrow N$ be defined as follows
      $f(x) = 3x + 2$ and $g(x) = x^2 + 1$ specify the functions.
      i) $f \circ g$ ii) $g \circ f$.
      If they exist, and give a valid argument if one/some of them do not exist.   [7+8]

3.   Check whether proposition $((\sim (A \leftrightarrow B) \wedge C) \vee (\sim A \rightarrow B))$ is well-formed, providing step-by-step tracing of the algorithm.   [15]

4.a) Explain the principle of strong induction with example.
  b) Using induction principles prove that $n^3 + 2n$ is divisible by 3.   [7+8]

5.   Find the general solution for the recurrence relation.
      $T(n) - T(n - 1) = 4(n + n^3)$, where $n \geq 1$, and $T(0) = 5$.   [15]

6.a) How many solutions does $x_1 + x_2 + x_3 = 11$ have, where $x_1, x_2, and\ x_3$ are nonnegative integers with $x_1 \leq 3, x_2 \leq 4, and\ x_3 \leq 6$?
  b) How many bits of string of length 10 contain
      i) Exactly four 1's   ii) At most four 1's.   [7+8]

7.   Define Graph. Graph 'G' is represented by the following adjacency matrix.
      $[0\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 1\ 0]$
      a) Draw the Graph.
      b) Determine whether G is a tree. Justify your answer?
      c) Determine whether G is Eulerian graph. Justify your answer?
      d) Determine whether G is Hamiltonian graph. If it is so, provide a Hamiltonian cycle on G.   [3+4+4+4]

8.   Show, step by step kruskal's algorithm on the following connected weighted graph and also calculate sum of the weights of the minimal spanning tree?   [15]

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