Name:

Enrolment No:

UPES
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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
END Semester Examinations (Online Mode), Dec 2020

Course: Discrete Mathematical Structures — **Semester:** III
Program: B.Tech. (SOCS All Branches) — **Time:** 03 Hrs
Course Code: CSEG 2006 — **Max. Marks:** 100

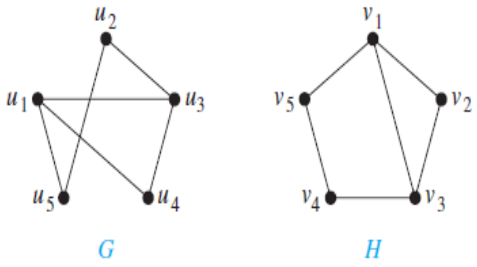
SECTION - A — 6 x 5 = 30 Marks

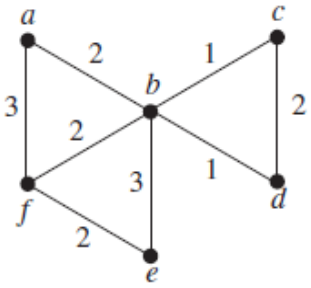
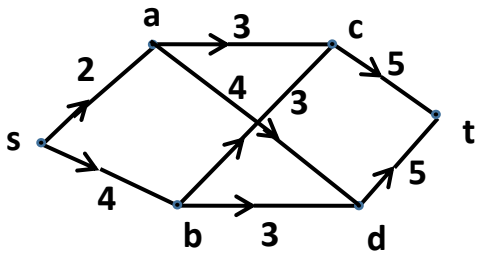
1. Each question carries 5 Marks.
2. Instruction: Select the correct option.

Q 1	If the relation $R = \{(i,j): \lvert i-j \rvert = 2\}$ is defined on the set $A = \{1,2,3,4,5,6\}$, then R is **A.** reflexive **B.** symmetric **C.** transitive **D.** reflexive and symmetric	**CO1**
Q 2	If the function $f: R \longrightarrow R$ is defined as $f(x) = \begin{cases} 3x-4 & x>0 \\ -3x+2 & x \le 0 \end{cases}$. Then $f^{-1}(2)$ is **A.** $\{0,2\}$ **B.** $\{0,1\}$ **C.** $\{1,2\}$ **D.** φ	**CO1**
Q 3	If a graph has four vertices of degree 1, 1, 2 and 3 then the graph is **A.** simple graph **B.** multigraph **C.** pseudo graph **D.** not possible.	**CO3**
Q 4	Which one is an Eulerian as well as Hamiltonian graph **A.** $K_{5,5}$ **B.** $K_{4,5}$ **C.** $K_{4,4}$ **D.** $K_{5,4}$	**CO3**
Q 5	The number of edges and number of vertices in N-cube graph (Q_4) are **A.** 32 and 16, respectively. **B.** 16 and 16, respectively. **C.** 16 and 32, respectively. **D.** 32 and 32, respectively.	**CO3**
Q 6	A tree has two vertices of degree 2, one vertex of degree 3 and three vertices of degree 4. How many vertices of degree 1 does it have? **A.** 4 **B.** 5 **C.** 6 **D.** 9	**CO4**

SECTION – B — 10 x 5 = 50 Marks

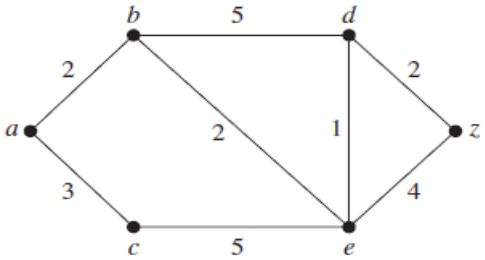
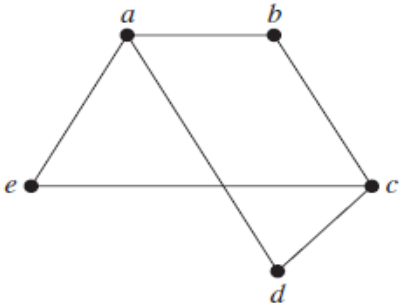
1. Each question carries 10 marks.
2. Instruction: Answer on a separate white sheet, upload the solution as an image.

Q 7	Determine the solution of the recurrence relation $y_n - 2y_{n-1} + y_{n-2} = n.2^n$ with $a_0 = 0$ and $a_1 = 1$.	**CO1**
Q 8	If $T: \mathbb{R}^3 \to \mathbb{R}^2$ is the linear transformation defined by $T(x,y,z) = (3x+2y-4z,\ x-5y+3z)$, then determine the matrix of T relative to the bases $B_1 = \{(1,1,1),\ (1,1,0),\ (1,0,0)\}$, $B_2 = \{(1,3),\ (2,5)\}$.	**CO2**
Q 9	Check whether the following graphs are isomorphic or not.  	**CO3**

Q10	Using Prim's algorithm, determine a minimal spanning tree for the given weighted graph. 	**CO4**
Q 11	Determine the maximum flow of the network as shown below using Ford-Fulkerson algorithm and the cut with capacity equal to this maximum flow. 	**CO4**

Section – C **1 x 20 = 20 Marks**

1. Each question carries 20 Marks.
2. Instruction: Answer on a separate white sheet, upload the solution as an image.

Q 12	Describe the Dijkstra's algorithm. Using this algorithm, determine the length of the shortest path and hence the shortest path in the graph as shown below from *a* to *z*.  **OR** Using the decomposition theorem, determine the chromatic polynomial, and hence the chromatic number of the graph as shown below. 	**CO3**