Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M.Tech(EDPS)/SEM-1/MT-M-101/2009-10

2009

ADVANCE ENGINEERING MATHEMATICS

Time Allotted : 3 Hours   Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* of the following.

1. a) Illustrate the following through examples with respect to a spanning Tree T of a graph G.

   i) Branches and chords of G. 2 + 2 = 4

   ii) Fundamental circuit and fundamental cut-set. 2 + 2 = 4

   b) Use Ford-Fulkirson algorithm to find a maximal flow starting from the given flow pattern : 6

Fig.

2. a) Define the terms Path Product and Transmission between two vertices of a contact network and illustrate through examples. 1 + 1 + 1 + 1 = 4

b) Write down the Transmission matrix and Primitive connection matrix of the following contact network.

5 + 5 = 10

Fig.

3. a) Define SC-network and SC-function illustrating through examples. 1 + 1 + 1 + 1 = 4

b) Design an SC-network for the SC-function between the vertices a and b of network given by

$$F_{ab} = x_1 x_2 x_3 x_5 x_7 + x_1 x_3 x_4 x_6 + x_1 x_5 x_6 x_8 x_2 x_4 + x_2 x_3 x_5 x_8 .$$ 10

4. A block box containing a switching network of seven switches — 1, 2, 3, 4, 5, 6, 7 — was subjected to the experiment shown in the following figure. The lamp was lit when each of the following combinations of switches was turned on, in addition to the external switch K : (1, 4, 5), (1, 4, 6, 7), (2, 5, 7), (2, 6), (3, 5) and (3, 6, 7). Show the switching network configuration.

3 + 3 + 2 + 2 + 2 + 2 = 14

Fig.

5. a) Define union, intersection and ring sum of two graphs illustrating with examples. 2 + 2 + 2 = 6

   b) Consider a graph G with 5 vertices and 7 edges. Consider any two subgraphs of g_1 and g_2 of G.

   Express G, g_1, g_2 as vectors over Galois field with addition modulo 2 and multiplication modulo 2 operations. Show that the ring sum $g_1 \oplus g_2$ corresponds to the addition modulo 2 operation of the respective vectors for g_1 and g_2.

2 + 2 + 2 + 2 = 8

6. a) Show that the vectors (2, 1, 4), (1, – 1, 2) and (3, 1, – 2) form a basis of R^3. 5

b) Find x such that $\begin{bmatrix} 2 & 1 & 4 \\ 1 & x & 2 \\ 4 & 0 & x+2 \end{bmatrix}$ is 2. 4

c) Solve by Gauss – Elimination method :

$$2x - y + 3z = 4$$

$$x + z = 2$$

$$2y + z = 3$$

5

7. a) Define Cauchy sequence and complete metric space and illustrate these notions in a metric space through examples and counter-examples. 2 + 2 + 2 + 2 = 8

b) Define a Hilbert space H. If $x, y \in H$ and $x \perp y$, then prove that

$$|| x + y ||^2 = || x ||^2 + || y ||^2$$

and $|| x - y ||^2 = || x ||^2 + || y ||^2$,2 + 4 = 6