C 22590 (Pages : 2) Name.............................

Reg. No..........................

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE (2014 SCHEME) EXAMINATION, APRIL 2017

Computer Science Engineering

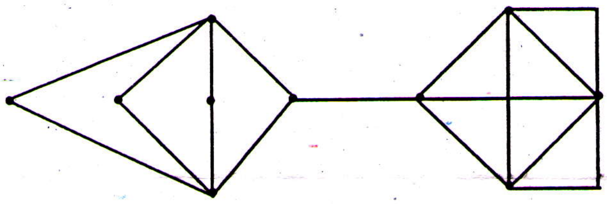
CS 14 605—GRAPH THEORY AND COMBINATORICS

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*
Each question carries 5 *marks.*

1. Define a planar graph. Show that K_5 is not a planar graph.
2. Find, if possible, an Euler trail or a semi-Euler trail in this graph :



3. How many different Hamilton's paths are there for Kn, n and $n = 1$?
4. Suppose that a graph G is regular of degree r, where r is odd :
   (i) Prove that G has an even number of vertices.
   (ii) Prove that the number of edges in G is a multiple of r.
5. Discuss about weighted tress and prefix codes.
6. Determine the number of positive integers n where $1 \leq n \leq 200$ and n is not divisible by 2, 3, 5.
7. Define (i) Cutset ; (ii) Edge connectivity ; (iii) Vertex connectivity with one example each.
8. In how many ways can one arrange the letters in APPLE so that :
   (i) There is no pair of consecutive identical letters.
   (ii) There are exactly two pairs of consecutive identical letters.
9. Find the generating function of $a_n + a_{n-1} - 6a_{n-2}$ for $n \geq 2, a_0 = -1$ and $a_1 = 8$.
10. Give the generating function for 1, 1, 1, 1, ... 1, 0, 0, 0 ... first terms are 1, others are 0.

(8 × 5 = 40 marks)

Turn over

Part B

*Answer **all** questions.*
Each question carries 15 marks.

1. (a) Show that in any connected planar graph with n vertices, e edges and f faces $e - n + 2 = f$ (Euler's formula).

Or

(b) Explain with an example, Chinese postman problem.

2. (a) Prove that the maximum flow possible between two vertices a and b in a network is equal to the minimum of the capacities of all cut-sets with respect to a and b.

Or

(b) Explain in detail biconnected components and articulation points of tree.

3. (a) In how many ways can the integers 1, 2, 3, ... 10 be arranged in a line so that no even integer is in its natural place.

Or

(b) Illustrate binomial theorem with neat example.

4. (a) Solve linear recurrence relation :

$$C_n = 3C_{n-1} - 2C_{n-2} \text{with } C_1 = 5, C_2 = 3.$$

Or

(b) Determine the sequence generated by exponential generating function :

$$e^{2x} - 3x^3 + 5x^2 + 7x$$
$$(3 + x)^3$$

(4 × 15 = 60 marks)