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Name......................................

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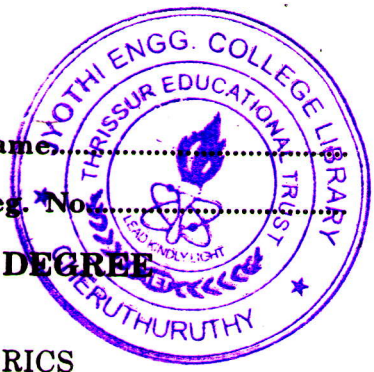
FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2007

IT2K 502—GRAPH THEORY AND COMBINATORICS

Time : Three Hours

Maximum : 100 Marks

Answer **all** *questions.*

Part A

1. (a) Define a graph. Show how it can be represented by a matrix with an example.

   (b) Describe the Chinese postman problem.

   (c) With the help of an example, show the pre-order and post-order traversals in a rooted tree.

   (d) Discuss a method to construct an efficient tree based on weights.

   (e) How many permutations of size 3 can one produce with the letters m, r, a, f and t ?

   (f) State (i) Rule of sum ; (ii) Rule of product.

   (g) Explain generating function with an example.

   (h) What do you mean by first-order linear recurrence relation ?

   (8 × 5 = 40 marks)

Part B

2. (a) (i) What do you mean by Hamilton cycle ? Check if the following graph contains a Hamilton cycle. Justify your answer.
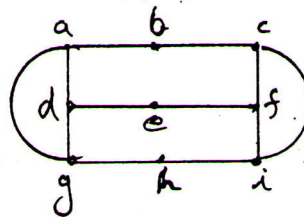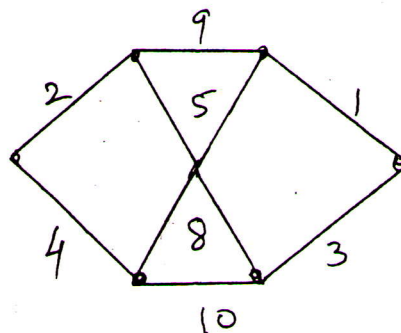

   (10 marks)

   (ii) Define a planar graph. Give an example.

   (5 marks)

   Or

   (b) State Euler's theorem and show how it is used to characterize platonic solids.   (15 marks)

3. (a) (i) Describe Prim's algorithm for finding minimum spanning tree. Apply the algorithm to the following graph :

   (10 marks)

   Turn over

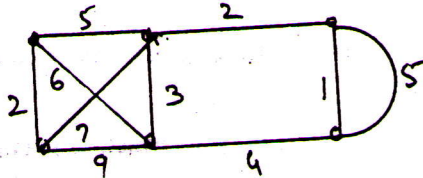(ii) Evaluate the following expressions :

(A) $+ 4/* 23 + 1 - 9 * 23$.

(B) $* + ab - c * de$

$a = 2 ; b = 3 ; c = 5; d = 1; e = 2$.

(5 marks)

Or

(b) (i) Describe Kruskal's algorithm. Apply it to find MST for the graph below :

(10 marks)

(5 marks)

(5 marks)

(ii) Define a Transport network. Give an example.

4. (a) (i) State the binomial theorem.

(ii) Determine the coefficient of :

(A) xyz^2 in $(x + y + z)^4$.

(B) xyz^2 in $(2x - y - z)^4$.

(10 marks)

Or

(b) (i) State the principle of inclusion and exclusion.

(7 marks)

(ii) Explain root polynomial with the help of an example.

(8 marks)

5. (a) (i) Find the generating function for the number of ways to select 10 chocolate icecreams from large supplies of 6 different brands.

(8 marks)

(ii) Determine the sequence generated by the following generating function :

$f(x) = (2x - 3)^3$.

(7 marks)

Or

(b) (i) State the exponential generating function for a sequence of real numbers.

(5 marks)

(ii) Solve the following recurrence relation :—

$$a_{n+1} - a_n = 2n + 3, \ n \geq 0$$
$$a_0 = 1$$

(10 marks)

[4 × 15 = 60 marks]