

Roll No. ....

**76454**

**M.Sc. Mathematics 3rd Semester  
Examination-December, 2015**

**ADVANCED DISCRETE MATHEMATICS-I**

**Paper : MM-514(A1)**

**Time : 3 hours**

**Max. Marks : 80**

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard will be entertained after the examination.

**Note :** Attempt **five** questions in all selecting one question from each Section. Q. No. 9 in Section V is **compulsory**.

**SECTION - I**

1. (a) Draw two 3-regular graphs with six vertices and eight edges. (8)

76454-2050-(P-7)(Q-9)(15)

( 1 )

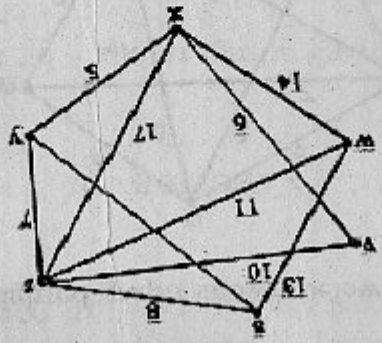
[ Turn Over

(b) Discuss the problem of bridges of Königsberg. (8)

**SECTION - II**

3. (a) Prove that the number of vertices is more than one, the number of edges in a tree. (8)

(b) Apply Dijkstra algorithm to find shortest path from s to each other vertex for : (8)



76454-2050-(P-7)(Q-9)(15) (3) [ Turn Over

(b) Classify the connected graphs which can be both regular and bipartite. (4)

(c) Let G be the graph (4)



Find :

(i) G-A

(ii) G-B

(iii) G-C

(iv) G-X

2. (a) If G is a connected graph and every vertex of G has even degree, then G has an Euler circuit. (8)

76454-2050-(P-7)(Q-9)(15) (2)



SECTION - III

5. (a) Construct a DFA that accepts the strings aabb, aab, abab, aabbb. (8)

(b) Define an NFA. Create an NFA of atleast three states. (8)

6. (a) Create a DFA of exactly 4 states and two input symbols. (8)

(b) Construct an NFA with three states that accept the language  $\{01, 010\}^*$ . (8)

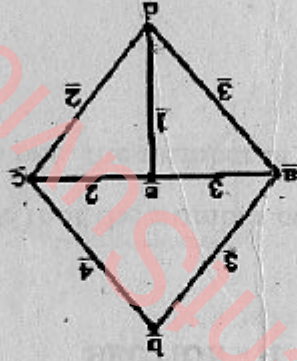
SECTION - IV

7. (a) Find all strings in  $L((a + b)^*b(a + ab)^*)$  of length less than four. (8)

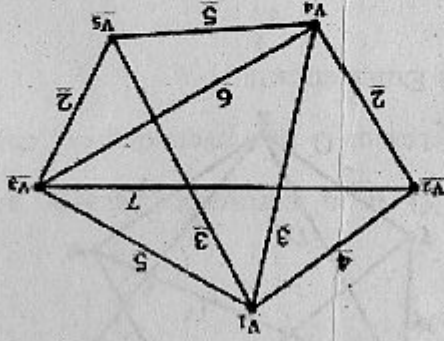
(b) State and prove Kleens theorem. (8)

76454-2050-(P-7)(Q-9)(15) (5) [ Turn Over

4. (a) Using Prim Algorithm. Find the spanning tree of the following graph. (8)



(b) Use Kruskal's algorithm to determine a minimal spanning tree for the connected weighted graph shown below : (8)



76454-2050-(P-7)(Q-9)(15) (4)



- (e) Define cut sets (2)
- (f) Define context sensitive grammar (2)
- (g) State pumping lemma (2)
- (h) What do you mean by isomorphism of trees? (2)

76454-2050-(P-2)(Q-9)(15) (7)

8. (a) What do you mean by context free grammar? How is it related to content free languages? (8)
- (b) Define a regular expression. What rules govern a regular grammar? (8)

#### SECTION - V

9. (a) Define DFA. (2)
- (b) Define transition table (2)
- (c) Define Ancestor and Descendent of a rooted tree. (2)
- (d) Define a cyclic graph (2)
- (6) 76454-2050-(P-7)(Q-9)(15)