



# RAN-0953

S.Y.B. Sc. Sem - IV Examination

March / April - 2019

Mathematics Paper: MCS - 401 Graph Theory

Time: 2 Hours ]

[ Total Marks: 50

सूचना : / Instructions

नीचे दृशविले निशानीवाणी विगतो उत्तरवही पर अवश्य लभवी.  
Fill up strictly the details of signs on your answer book

Name of the Examination:

S.Y.B. Sc. Sem - IV

Name of the Subject :

Mathematics Paper: MCS - 401 Graph Theory

Subject Code No.: 0 9 5 3

Seat No.:

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Student's Signature

**Instruction:**

- (1) All questions are compulsory.
- (2) Figures to the right indicate marks of corresponding question.
- (3) Follow usual notations.
- (4) Use of non-programmable scientific calculator allowed.

**Q-1] Answer the following:**

**[10]**

- 1] Define complete graph with illustration.
- 2] In a m-ary tree what is the degree of interior vertices and leaves?
- 3] Define a walk and a path.
- 4] Find the number of edges, interior nodes and leaves for a binary tree with 17 nodes.
- 5] State the number of Hamiltonian circuits in a complete graph with 9 vertices.

**Q-2] Answer (any two) of the following:**

**[10]**

- 1] Explain Utility problem.
- 2] If  $G = \{V, E\}$  is a simple connected planar graph with more than one edge then prove that it must satisfy the following inequalities:  
(i)  $2|E| \geq 3R$  (ii)  $|E| \leq 3|V| - 6$
- 3] Prove that Kuratowski's second graph is non-planar.

**Q-3] Answer (any two) of the following: [10]**

- 1] Show that a connected graph remains connected after removing an edge  $e$  from  $G$  iff  $e$  is in some circuit of  $G$ .
- 2] Prove that a simple graph with  $n$  vertices and  $k$  components has at the most  $[(n-k)(n-k+1)]/2$  edges.
- 3] Define the following with illustration:  
(i) Disconnected graph (ii) Euler Path (iii) Complete graph

**Q-4] Answer (any two) of the following: [10]**

- 1] Show that in a complete graph with  $n$  vertices, there are  $(n-1)/2$  edge disjoint Hamiltonian circuits if  $n$  is an odd number  $\geq 3$ .
- 2] Define the following with illustration:  
(i) Fusion (ii) Deletion (iii) Hamiltonian Circuit
- 3] Show that a connected graph remains connected after removing an edge  $e$  from  $G$  iff  $e$  is in some circuit of  $G$ .

**Q-5] Answer (any two) of the following: [10]**

- 1] For any positive integer  $n$  if  $G$  is a connected graph with  $n$  vertices and  $n-1$  edges then  $G$  is a Tree.
- 2] Determine the number of leaves on a binary tree with 21 vertices.
- 3] Prove that every connected graph has atleast one spanning tree.

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