

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**MID SEMESTER EXAMINATION**

**SUMMER SEMESTER, 2018-2019**

**DURATION: 1 Hour 30 Minutes**

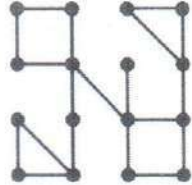
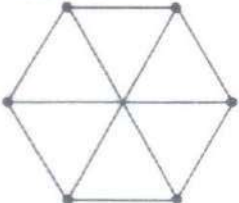
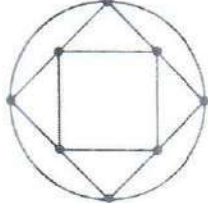
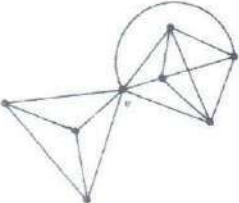
**FULL MARKS: 75**

**CSE 4803: Graph Theory**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

1. a) Define with example (figure if necessary) 2×5
  - i. Eccentricity
  - ii. Rank
  - iii. Semi-Eulerian Graph
  - iv. Cut-Vertex
  - v. Bipartite Graph
- b) Use Cayley's theorem to draw the labeled tree represented by the sequence (1,5,5,1,2). After drawing the graph interchange the labels 1 and 5. Then, recalculate the labeled sequence. 5+5
- c) Prove that there are at least two pendant vertices in any tree with two or more vertices. 5
2. a) How many vertices and edges does each of the following graphs have? 5×2
  - i.  $K_{m,n}$
  - ii.  $C_n$
  - iii.  $W_n$
  - iv.  $Q_n$
  - v.  $K_n$
- b) Define Hamiltonian Cycle. Prove that a complete bipartite graph  $K_{3,4}$  does not have a Hamiltonian Cycle. 2+5
- c) Let  $G$  be a simple graph on  $n$  vertices and  $m$  edges. If  $G$  has  $k$  components, then prove that  $G$  satisfies:  $n-k \leq m \leq (n-k)(n-k+1)/2$  8
3. a) Define spanning tree. How many spanning trees does the following graph have? 2+6  
 [Hint: If an edge of a graph is a 'bridge', then it must belong to every spanning tree generated from the graph.]
 
- b) Prove that any simple graph with  $n$  vertices and more than  $(n-1)(n-2)/2$  edges is connected. 7
- c) Prove that a connected planar graph with  $n$  vertices and  $e$  edges has  $e-n+2$  regions. 10
4. a) Determine: Edge connectivity, Vertex connectivity and Cocycle (at least six of them) for the following graphs: 4×3
  - i. 
  - ii. 
  - iii. 
- b) Prove that a connected graph  $G$  is Eulerian if and only if the degree of each vertex of  $G$  is even. 8
- c) Mention the common properties of Kuratowski's graphs. 5