## M.Sc. First Semester End Examination, 2023
### (Regular & Supplementary Paper)
### Applied Mathematics with Oceanology and
### Computer Programming

### MTM – 106
### (GRAPH THEORY)

**Full Marks: 25**                              **Time: 01 Hr**

*The figures in the right hand margin indicate mark.*
*Candidates are required to give their answers in their own words as*
*far as practicable.*
*Illustrate the answers wherever necessary*

### Group - A

1. **Answer any two questions from the following :**        2x2=4

   a) How many vertices are there in a graph G wqith 15 edges, if each vertex is of degree 3?                          2

   b) Define isomorphic graph and give an example.         2

   c) Let T be a tree having even number of edges. Show that T must have at least one even vertex.                    2
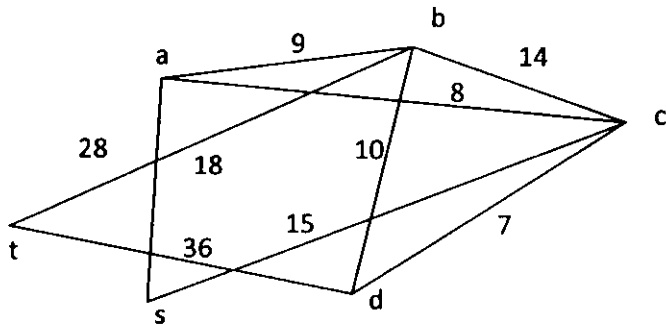
### Group - B

2. **Answer any two questions from the following :**        4x2=8

   a) Explain fundamental cut-set. With respect to a given spanning tree T, show that a branch $b_i$ that determines a

fundamental cut-set S is contained in every fundamental circut associated with the chords in S and in no others. 4

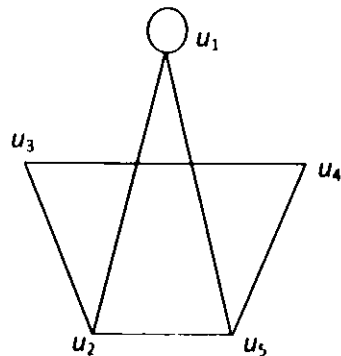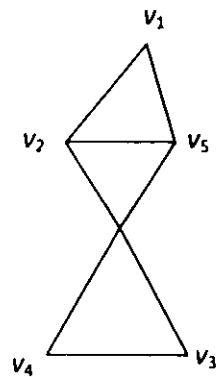b) Define Planar graph and prove that the graph $K_{3,3}$(Kuratowski's second graph) is non-planar. 4

c) Using Dijktroa's algorithm, find the lengths of the shortest path from the source vertex s to a,b,c,d and t of the following heighted graph. 4



**Group - C**

3. **Answer any one question from the following :** **8x1=8**

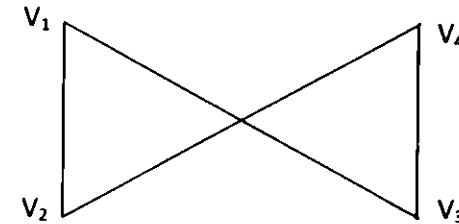a) i) Examine whether the following two graphs are isomorphic or not. 2

ii) In a graph of n(>1) people of Kolkata examine whether there are at least two people with exactly the same number of friends. 3

iii) Prove that a bipartite graph does not contain odd cycle. 3

b) Write down the statement of four-colour problem in graph theory. Consider the graph shown in figure, find the number of walks of length three from $V_2$ to $V_4$ and also check the connectedness of the graph. 2+2+4



**[Internal Marks – 05]**