UPES

UNIVERSITY OF PETROLEUM & ENERGY STUDIES
End Term Examination, December 2017.

Name of the Program: **M. Tech (PLE)**   .   Semester: **III**
Subject Title: **Pipeline Network Analysis**   Subject Code: **MATH 801**
Duration: **3 Hours.**   Max. Marks**: 100**
Question paper contains two sections A, B.

SECTION A
Answer all questions. (20)

1) i) What are applications of network analysis to Gas system   05
   ii) Derive equation for total equivalent length in pipes in series   05
   iii) Describe CNG infrastructure in CGD   10

SECTION B
Answer all questions. (40)

2. i) Discuss Network Topology and construct branch nodal incidence for the following Network (Assume directions and in the network)   10
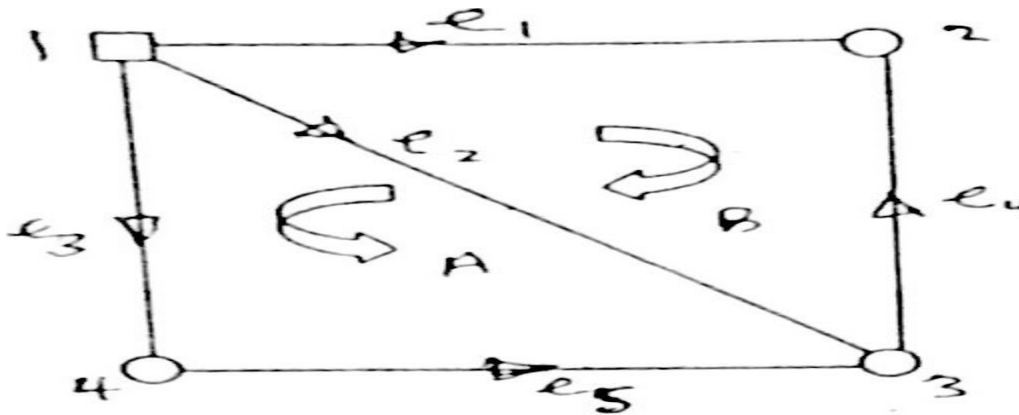

ii) Construct following matrix for above figure   10
   • Branch Loop incidence matrix
   • Partitioned Matrix of the above Matrices

3) For the pipeline networks given below, following information is available. Loads $L_2 = 100$, $L_3 = 150$, $L_4 = 75$. Pressure at node 1 is 30mbar gauge. Pipe diameters $D_1=D_2=D_3=75mm$; $D4=D5=50mm$. length of pipe legs 1,2,3 are 100 m each but 4 and 5 are 50m long each.Using
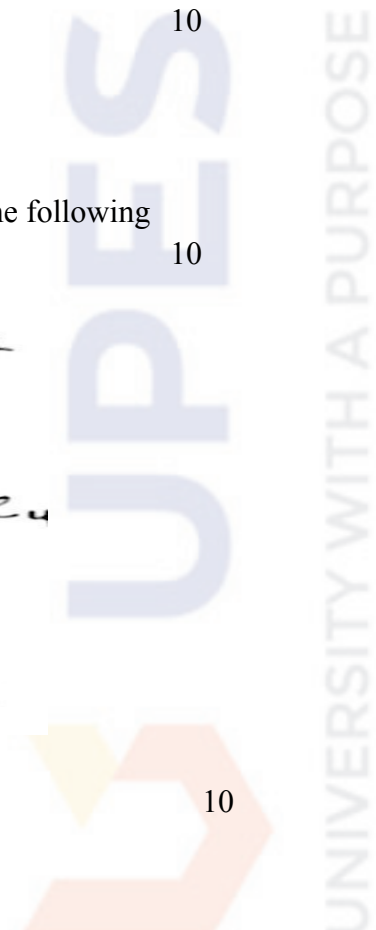
hardy cross method, find gas flow rate in each pipe leg and pressure at each node. Carry out three iteration and the check if the loop errors have decreased.   20

K= 11.7 * 10^3 L/ D^5
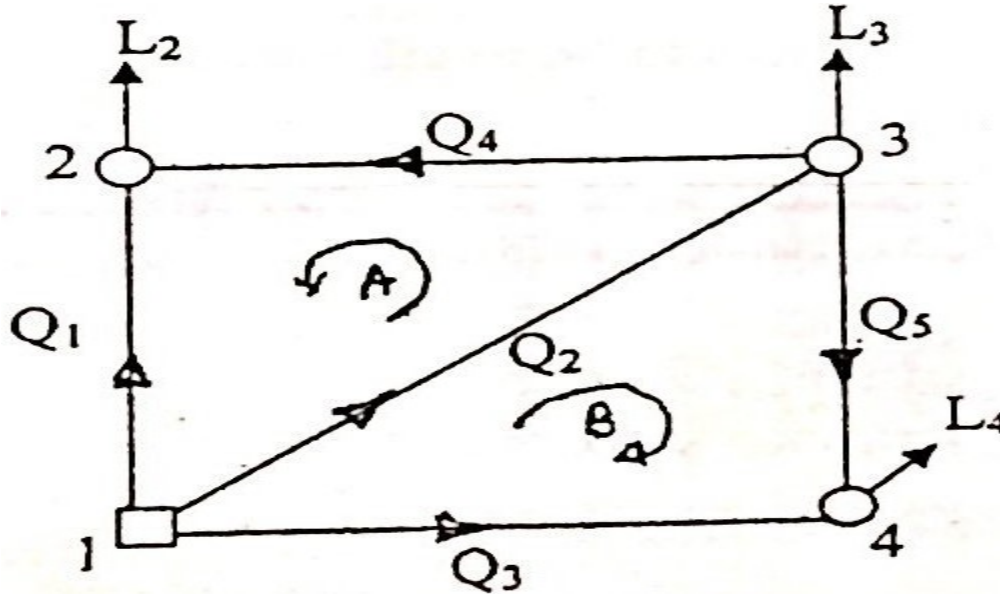
SECTION C
Answer any two Questions (20×2=40)
4. a) Explain transient analysis and write equations used for transient analysis   10
   b) Write Kirchhoff's first and second law in matrix vector notation form   10

5. Natural gas is supplied through a low-pressure distribution pipe 1200m in length with an initial pressure 50mbar (gauge) at A and a final pressure of 30mbar at B. It is required to increase the flow rate by 30%, 50 %, 70 %, 90 % and 100% by reinforcing the existing pipe with parallel Pipe of the same diameter as the original pipe. What length of reinforcement pipe must be installed if the pressure drop is to remain unchanged? Plot a graph of capacity vs reinforcement and comment on your results   20

6. Derive equation for correction factor of Newton nodal method and Compare Hardy Cross Method with Newton Nodal Method   20