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UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech (APE-GAS)	**Semester – : V**
Subject (Course): City gas Distribution & Pipeline Network analysis	**Max. Marks : 100**
Course Code : PTEG 442	**Duration : 3 Hrs**
No. of page/s: 02	

- **Assume appropriate data if missing.**
- **In natural gas industry, the terms, units, codes having their own meaning which are mentioned in this question paper.**
- **Draw graphs, sketches wherever necessary.**
- **Answer the entire question at one place. Start each question in new page.**

Section-A

Answer all the questions 60 M

1.Enlist the facilities at city gate station (CGS) and write functioning of each facility. 10 M

2.Name the various kinds of metering systems to measure the natural gas flow, how each meter is working, describe? 10 M

3.Define Mother Station, Daughter station, Online station of CNG network analysis 10 M

4.A pipe 6-cm in diameter, 1000m long and with friction factor = 0.018 is connected in parallel between two points M and N with another pipe 8-cm in diameter, 800-m long and having friction factor = 0.020. A total discharge of 20 L/s enters the parallel pipe through division at A and rejoins at B. Estimate the discharge in each of the pipe by using Panhandle-A and Panhandle-B gas flow equations. 15 M

5. A natural gas transmission line transports 4 million m^3/day of gas from a processing plant to a compressor station site 100 km away. The pipeline can be assumed to be along a flat terrain. Calculate the minimum pipe diameter required such that the maximum pipe operating pressure is limited to 8500 kPa. The delivery pressure desired at the end of the pipeline is a minimum of 5500 kPa. Assume a pipeline efficiency of 0.92. The gas gravity is 0.60, and the gas temperature is 18°C. Use the Weymouth equation, considering a base temperature is 15°C and base pressure is 101 kPa. The gas compressibility factor $Z = 0.90$. 15 M

SECTION-B

Answer any two questions 40 M

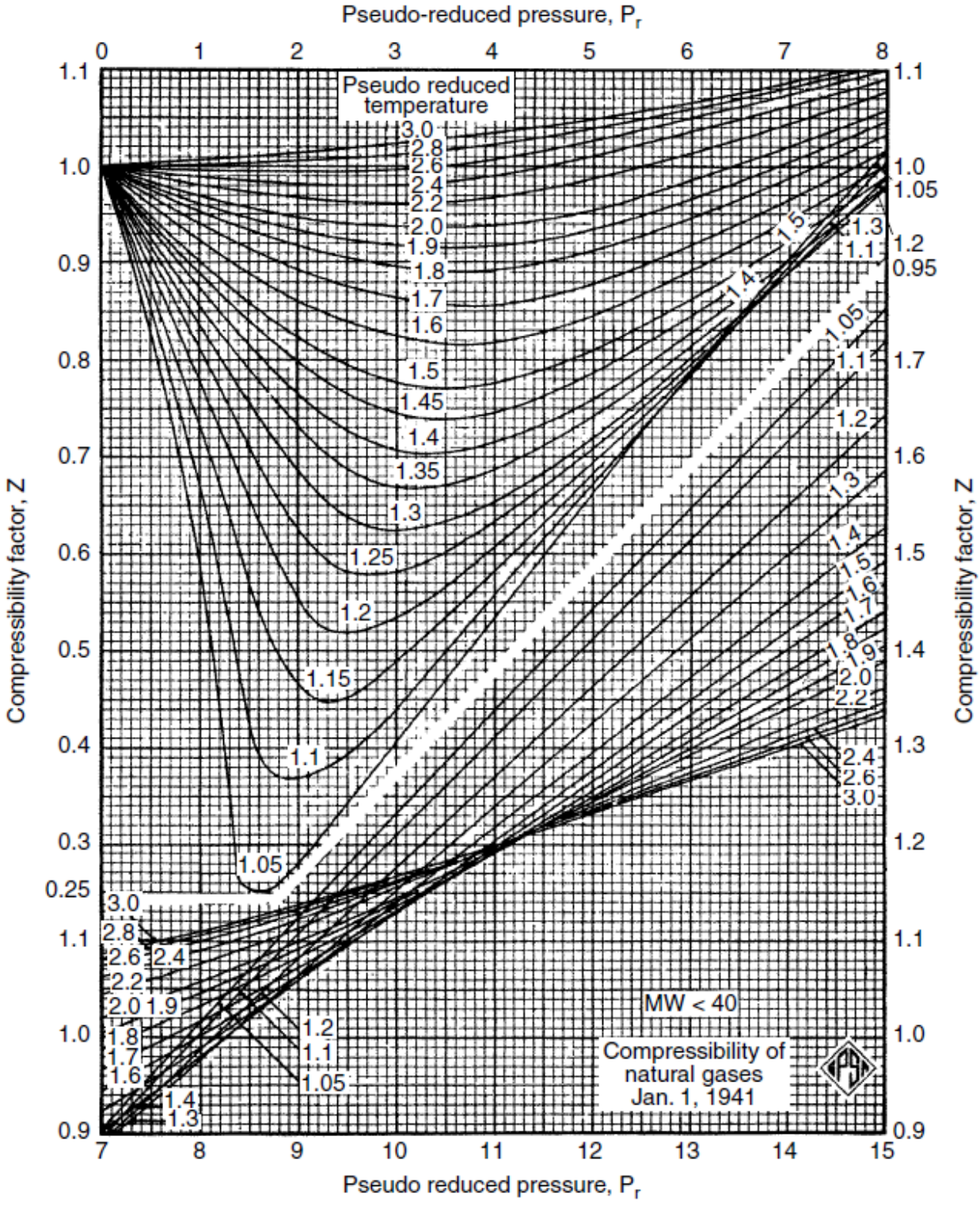
6.For the square loop shown in below figure, find the discharge in all the pipes by using hardy-cross method. All pipes are 1 km long and 300 mm in diameter, with a friction factor of 0.0163. Assume that minor losses can be neglected.

20 M

7. A gas reinjection project requires the compression of a 0.6 gravity natural gas from 100 psia and 80^0F to 2700 psia. Inter coolers cool the gas to 100^0F.

(a) Determine the minimum number of compression stages required for optimum compression efficiency
(b) Carefully sketch an enthalpy-entropy diagram and draw the path taken by the process.
(c) What are the temperatures of the gas the ends of the first and last stages of compression?
(d) Calculate the total adiabatic horsepower required to compress 1 MMscfd of this natural gas
(e) What is the heat load on the intercoolers? 20 M

8. Write the general orifice-equation, state significance of each parameter of the equation. 20 M



igure 1.2 Compressibility factor chart for natural gases. (From Gas Processors Suppliers Association, *Eng. Data Book*, Vol. II. With permission.)

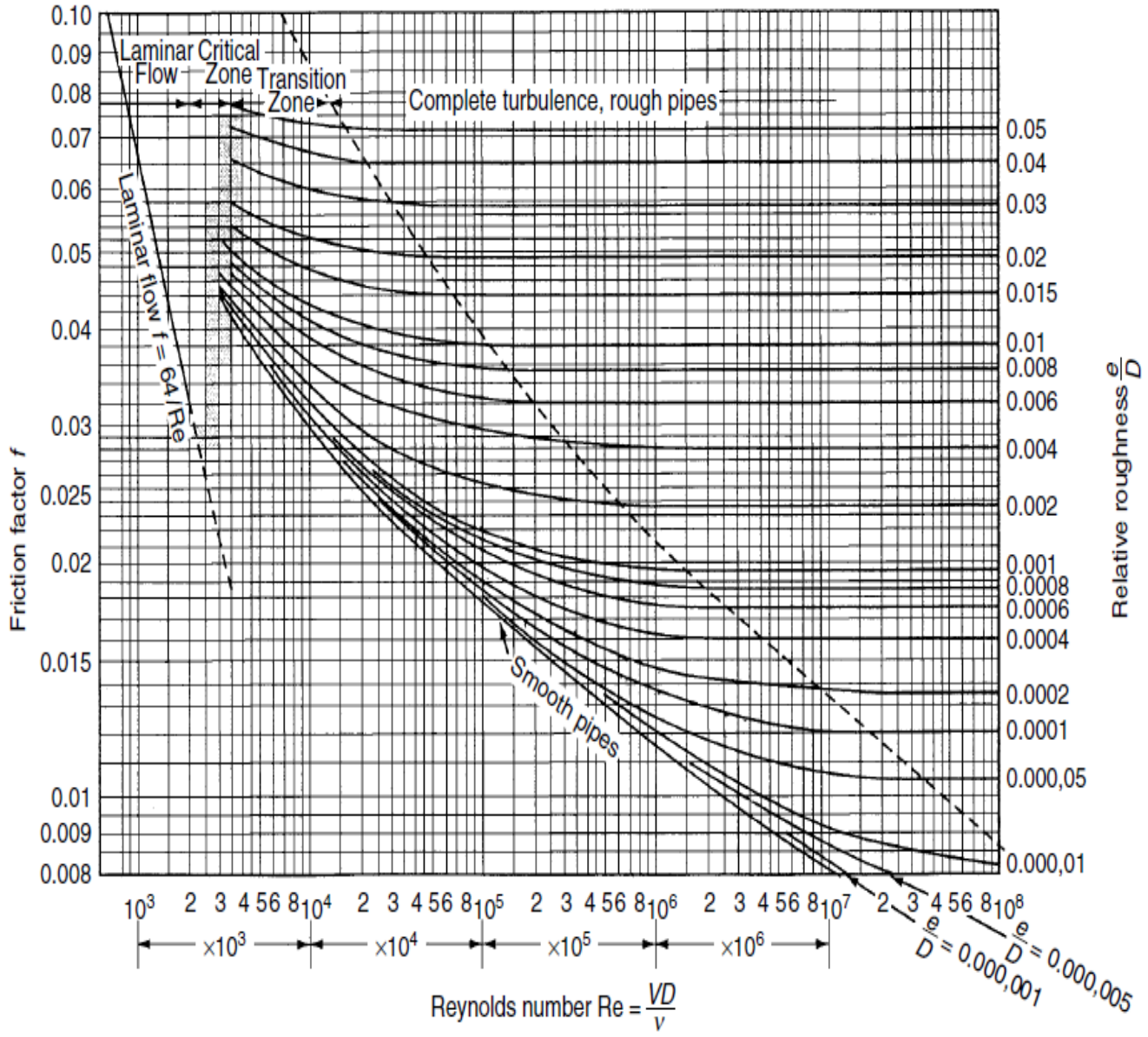


Figure 2.3 Moody diagram.

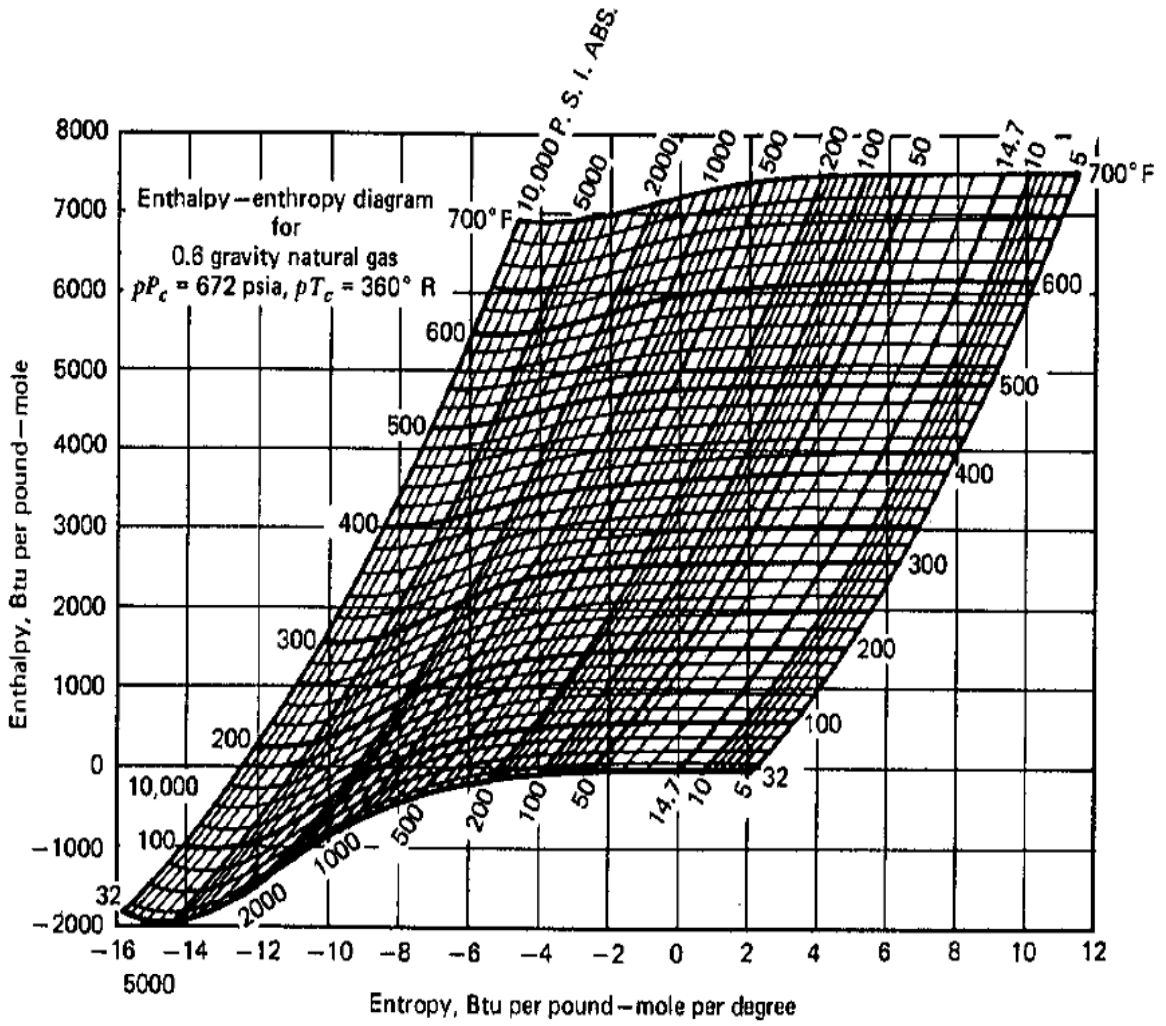


Fig. 3.9 Enthalpy-entropy diagram for 0.6-gravity natural gas. (After Brown.)