[3563] – 240

T.E. (Petroleum) (Sem. – II) Examination, 2009
DESIGN OF PETROLEUM MACHINERY
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer Q. No.* ***1*** *or Q. No.* ***2****, Q. No.* ***3*** *or Q. No.* ***4****, Q. No.* ***5*** *or Q. No.* ***6*** *from Section –* ***I*** *and Q. No.* ***7*** *or Q. No.* ***8****, Q. No.* ***9*** *or Q. No.* ***10****, Q. No.* ***11****or Q. No.* ***12*** *fromSection–****II****.*

2) Answers to the ***two*** *Sections should be written in* ***separate*** *books.*

3) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*

4) Black figures to the ***right*** *indicate* ***full*** *marks.*

5) ***Use*** *of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is* ***allowed****.*

6) Assume suitable data, ***if necessary****.*

SECTION – I

1. a) Describe in brief general procedure and general considerations in machine design. **9**

   b) Find the diameter of a solid steel shaft to transmit 20 KW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 400 MPa and a factor of safety as 8. If this shaft is to be replaced by a hollow shaft, find the inside and outside diameters if the ratio of inside to outside diameters is 0.5. **9**

OR

2. Power is to be transmitted from an electric motor to a pump. Design a cast iron protective type flange coupling to transmit 15 KW at 880 r.p.m. Assume service factor as 1.35 and following data. **18**

   Shear stress for shaft, bolt, and key = 38 MPa

   Crushing stress for bolt and key = 75 MPa

   Shear stress for C.I. = 8 MPa.

   Draw a neat sketch of this coupling.

   (Select suitable size of key and no. of bolts)

P.T.O.

3. a) Write the advantages and disadvantages of chain drive over belt or rope drive. **8**

   b) Two pulleys, one 425 mm diameter and the other 200 mm diameter, on parallel shafts, 1.9 metre apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between each pulley and the belt. **8**

   Also calculate the power transmitted by the belt when the larger pulley rotates at 210 r.p.m.; and the maximum permissible tension in the belt is 1.1 KN. The coefficient of friction between the belt and pulley is 0.23. Tension in the tight side of the belt and slack side of the belt has a ratio of $\frac{T_1}{T_2} = 2.387$.

   OR

4. a) Write in brief design considerations for a drill string.

   Also mention different types of stresses induced in various important components of a rotary system. **8**

   b) What is clutch and brake ? Draw the schematic sketch and explain working of any one type of brake. **8**

5. a) Water is being pumped from the reservoir at a rate of 25 ft^3/sec. The water level in the reservoir is 6.0 ft below the pump. Atmospheric pressure is 14.7 Psia and water temperature is 40°F. Assume a total head loss in the suction pipe of 4.0 ft. If the value of $NPSH_{(minimum)}$ given by the manufacturer is 20 ft., and vapour pressure and density of water are 18.5 $\frac{lb}{ft^2}$ and 62.4 $\frac{lb}{ft^3}$, check whether this pump is safe from cavitation effects ? **8**

   b) Draw the neat schematic sketch and explain a typical hydraulic circuit with its components. **8**

   OR

6. a) Water is being pumped from the lower reservoir to the upper reservoir. Calculate the horsepower required, assuming 75% pump efficiency. Following data is given with reference to Bernoulli's equation $z_1 = 97.5$ ft, $z_2 = 132.0$ ft. System is open to atmosphere with negligible surface velocity in both the reservoirs. Pipe line diameter is 24 inch and water flow rate is 23 cubic feet per second. The frictional head loss given per feet of 3600 ft. long pipe is 0.0076 ft/ft. Neglect minor losses and energy head removed from the pipeline is zero. **8**

b) Draw the schematic sketch of a mud circulation system. indicate all the components. **4**

c) Discuss the design considerations for pipeline transportation of oil and gas in brief. **4**

SECTION – II

7. a) How a thin cylindrical shell may fail,, if it is subjected to an internal pressure ? Derive an equation to calculate hoop stress and longitudinal stress. Draw the sketch and indicate cross-section as well as line of failure in both the cases. **9**

b) A thin cylindrical pressure vessel of 1.3 m diameter generates steam at a pressure of 1.75 N/mm^2. Find the minimum wall thickness, if the longitudinal stress and circumferential stress not to exceed 30 MPa and 40 MPa respectively. **5**

c) Write a note on, 'sealing materials and gaskets'. **4**

OR

8. a) Describe with sketches various types of heads used for pressure and reaction vessel. **8**

b) Design the nozzle using area for area method of compensation, following information is available. **10**

internal design pressure = 0.33 N/mm^2

internal diameter = 150 mm

material stainless steel = 0.5 Cr 18 Ni Mo 3

design or permissible stress = 130 N/mm^2.

Joint efficiency = 1.

Neglect corrosion allowance. Nozzle is to be welded to Head of thickness 2.66 mm and actual thickness nozzle is 3 mm. Work out the nozzle reinforcement.

9. a) Draw the neat schematic sketches and indicate various types of jackets and coils used along with reaction vessels. **10**

   b) Discuss in brief stepwise design procedure for a shell and tube heat exchanger along with relevant equations or formulae. **6**

OR

10. Calculate following parameters for a shell and tube heat exchanger data given below. **16**

   a) square pitch of tubes

   b) shell thickness

   c) nozzle-thickness (diameter 70 mm)

   d) head-thickness

   e) thickness of tube

   f) tube sheet thickness.

   Shell side (Material-Carbon Steel)

   No. of shells-1 Working pressure = $0.32 \frac{N}{mm^2}$

   No. of passes-1 Design pressure = 0.49 N/mm^2

   Fluid water-1 Temperature inlet = 30°C

   Temperature outlet = 50°C

   Head

   Crown radius - 390 mm. Knuckle radius = 40 mm

   Nozzles - inlet and outlet - 70 mm.

   Vent - 22 mm

   Drain - 22 mm

   Opening for relief valve 50 mm

   Permissible stress for Carbon steel = 90 N/mm^2

   Permissible stress for bolt = 140 N/mm^2

Tube Side

Tube and tube sheet material - stainless steel

No. of tubes = 54

Outer diameter = 18 mm

Length = 12 metre

Pitch (square) = 25 mm

Fluid Carbon dioxide

Working pressure = 18 N/mm^2

Design pressure = 20 N/mm^2

Inlet temperature = 150°C

Outlet temperature = 55°C

Permissible stress = 100 N/mm^2

Assume corrosion allowance of 3 mm.

Joint efficiency and other data may be assumed as per standard practise.

11. Which operations are influenced by agitation or mixing ? What is the basis for classification of the agitation or mixing equipment ? **16**

Draw the neat schematic sketch of an arrangement of a typical agitation system with its drive components. Indicate all the parts and explain in brief the design considerations for this agitation system.

OR

12. Design a fixed conical roof storage tank, for following data : **16**

Tank diameter = 18 meter

Tank height = 10 metre

Sp gravity of liquid = 0.96

Conical roof

Slope permissible 1 in 5

Superimposed load = 1250 N/m^2

Material : Carbon steel (structural)

Permissible stress = 140 N/mm^2

Modulus of elasticity = 2×10^5 N/mm^2

Weight of roof plate per unit area is given = 460 N/m^2

Also draw a neat schematic sketch of this tank.

[3563] – 239

T.E. (Petroleum) (Semester – II) Examination, 2009
PRINCIPLES OF CHEMICAL ENGINEERING – II (2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answer question numbers* ***1*** *or* ***2,3*** *or* ***4,5*** *or* ***6,7*** *or* ***8, 9*** *or* ***10,11*** *or* ***12****.*
2) Answers to the ***two*** *Sections should be written in* ***separate*** *books.*
3) ***Neat*** *diagrams must be drawn* ***whenever*** *necessary.*
4) Black Figures to the ***right*** *indicate* ***full*** *marks.*
5) ***Assume*** *suitable data,* ***if necessary****.*
6) ***Use*** *of logarithmic tables, slide rules, electronic pocket calculator is* ***allowed****.*

SECTION – I

1. a) Define relative volatility and explain its significances. **4**

   b) Both Tray Column and Packed Towers are very common for industrial purposes explain merits and demerits of them. **6**

   c) Develop expression for steady state diffusion through thin film. **6**

   d) What is HETP ? What is its importance ? **2**

   OR

2. a) Derive the expression of operating line for enriching section of a distillation column with the help of McCabe Thiele method. **6**

   b) Define the term ‘q’ for Distillation Column. What is q-line ? With the help of neat diagram explain location of q – line for various feed conditions. **6**

   c) Discuss important characteristics of packing materials. **6**

P.T.O.

3. a) Why we feel too much hot and suffocating at 40° C temperature with 90% relative humidity compared to same temperature but 30% humidity. **4**

   b) Define the followings :

      i) Dry Bulb Temperature

      ii) Wet Bulb Temperature

      iii) Dew Point

      iv) Percentage Saturation **6**

   c) With help of neat diagram explain operation of cooling tower. **6**

OR

4. a) Name four different types of membrane separation processes and provide their pore dimensions as well. **4**

   b) Write a short note on liquid – liquid extraction process. **4**

   c) What is supercritical fluid extraction ?Give its applications. **4**

   d) There are some similarities among heat, momentum and mass transfers-explain. **4**

5. a) Gasoline is obtained in a refinery at rate of 2500 kg/hr is to be cooled from 80°C to 45° C using utility water available at 25° C.

      Calculate : i) Heat Duty

      ii) Water flow rate, if water can be raised by a max. temp. of 5°C.

      Data : C_p of gasoline = 1.88 kJ/ (kg C). **6**

   b) What do you mean by fouling factor ? Why is it so important for designing heat exchangers. **4**

   c) Write down stepwise procedure of designing shell and tube heat exchanger. **6**

OR

6. a) Name four different types of heat exchangers and their uses. **4**

   b) Write a short note on selection of fluids through shell and tube side of an exchanger. **4**

   c) In a 135 TPD p-Xelene plant, final product leaves overhead condenser at 148° C, which is to be cooled to 35° C before pumping to storage tank. Cooling water is available at 30°C, which can at max. be raised to 35°C. Considering 1 -1 pass countercurrent shell and tube heat exchanger, with overall heat transfer coefficient of 1465 kJ/(m2 .hr. °C),

   Calculate i) Heat duty, ii) Water flow rate iii) LMTD and iv) Area to be provided by the heat exchanger.

   Data : Density of p-xylene = 840 kg/m^3, C_P for p-xylene = 2.093 kJ/kg K. **8**

SECTION – II

7. a) What are the primary causes of air pollution ? What are the possible ways to get rid of them to minimize the damage. **6**

   b) "Polluted water causes several diseases"- Explain with the help of proper examples. Highlight different methods of purifying the water. **6**

   c) Write short notes on : **6**

   i) Ozone Layer Depletion

   ii) Acid Rain

OR

8. a) What is HAZOP study ? How is it done ? Explain its significances. **6**

   b) With the help of neat diagram explain Activated Sludge Process and highlight its importance. **6**

   c) What are particulate matters ? How do they cause harm ? Discuss methods to control them. **6**

9. a) Development of P&ID requires input from various engineering disciplines Explain. Write down importance of P&ID. **6**

   b) With the help of neat diagram explain different key components of Rig Layout. **6**

   c) What is the role of plant layout engineer ? **4**

OR

10. a) Discuss salient points on selection of location for a chemical plant – explain each of them in nutshell. **6**

    b) Differentiate between PFD and P&ID. **6**

    c) Discuss equipment arrangement and its elevation in a process plant. **4**

11. a) What do you mean by fabrication in piping engineering – explain in details. **6**

    b) What is economic pipe diameter ? Highlight its importance. **4**

    c) Name various types of insulating material used by piping engineers. **6**

OR

12. a) With help of neat diagram explain working of the followings : **8**

    i) Butterfly Valve

    ii) Needle Valve

    iii) Check Valve

    b) Write short notes on : **8**

    i) Non-destructive testing of pipelines

    ii) Cross – Country pipelines.

———————

[3563] – 237

T.E. (Petroleum Engineering) (Semester – II) Examination, 2009
PROPERTIES OF RESERVOIR ROCKS AND FLUIDS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answers to the **two** Sections must be written in **separate** answer books.*
*2) Question No. **4 (four)** and No. **5 (five)** are **compulsory**.*
*3) Attempt **three** questions from **each** Section.*
*4) Figures to the to the **right** indicate **full** marks.*
*5) **Neat** diagrams must be drawn **wherever** necessary.*
*6) **Use** of non-programmable calculator is **allowed**.*
*7) Assume **suitable** data, **if necessary**.*

SECTION – I

1. a) Derive an expression for linear turbulent flow of a gas in porous media. **12**

   b) Find the gas flow rate when a consolidate sand core 2 cm in diameter and 5 cm long has a permeability of 225 md and a porosity of 20%. Air at 75 F is injected into this core. The inlet pressure is 100 psia and the outlet pressure is 14.7 psia. The viscosity of air is 0.02 cp and the compressibility is assumed to be 1.0. Beta is 0.97 atm-sec^2/g. **4**

2. a) Draw the stress-strain diagram for cast iron and shale on the same graph. Name and explain important points on the graph. **4**

   b) Explain Mohr's circle and Coulumb criteria. **12**

3. a) Define B_o, μ_o, c_o, c_g and explain their graphs with pressure. **4**

   b) What is the approximate range of the above properties in oil field units ? Give the SI units for these properties. **4**

   c) Explain the different reservoir fluids. **8**

4. Define porosity, permeability, saturation and capillary pressure and explain one technique to measure each property. **18**

P.T.O.

SECTION – II

5. a) Derive an expression for capillary pressure considering the weight of the spherical meniscus is not negligible. **4**

   b) Use the above formula for capillary pressure and derive a modified Purcell Burdine Equation ? **14**

6. a) Draw PT diagram for single component, two component and multicomponent systems. **6**

   b) Explain the concept of retrograde vaporization on a PT diagram. Where does such a phenomena occur in Petroleum Engineering ? **6**

   c) What is a pseudo-ternary diagram ? Explain an application using it in Petroleum Engineering. **4**

7. a) Given the following table for the components of a mixture. Find N_g and N_L. Use Newton Raphson and iteration methods to solve the problem. Do only one iteration and compare the first iteration value. **8**

   b) Write a note on convergence values. **4**

   c) Can you solve the same problem with an EOS ? Explain in detail. **4**

Component	Z_i	K_i
C_3	0.8	1.45
nC_4	0.1	0.5
nC_5	0.1	0.2

8. a) What is an EOS ? **4**

   b) Derive the Peng Robinson EOS in terms of Z. **8**

   c) What is the usefulness of an EOS to Petroleum Engineering ? **4**

[3563] – 236

T.E. (Petroleum Engineering) (Semester – II) Examination, 2009
PETROLEUM GEOLOGY – II
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answers to the questions of* ***both*** *the Sections should be written in* ***separate*** *answer books.*
2) Draw neat diagrams ***wherever*** *necessary.*

SECTION – I

1. A) Explain the terms : sour gas, sweet crude, gas hydrate, porphyrins, and geochemical fossils. **15**

OR

A) With the help of neat diagrams give important types of subsurface occurrences of petroleum. **5**

B) What is the importance of study of oilfield produced water ? Explain one chemical and one genetic classification of oil field water. **10**

2. A) Under what conditions organic matter is accumulated in a sedimentary basin ? **8**

B) Explain the properties that a rock should possess to quality as a reservoir rock ? **7**

OR

2. Give geochemical aspects of transformation of organic matter to hydrocarbons in nature with the help of neat diagrams. **15**

3. Answer **any two** of the following : **20**

A) Write a detailed note on "Kerogen".

B) Describe various types of structural traps with the help of neat sketches.

C) Give known mechanisms of primary and secondary migration.

P.T.O.

SECTION – II

4. A) Explain in brief important marine environments of deposition with sketches. **15**

OR

4. Write notes on **any three** of the following : **15**

A) Diagenesis

B) Types of carbonate porosity

C) Maturation of hydrocarbons in reservoir rocks

D) Significance of transgressive and regressive cycles in relation to petroleum occurrence.

5. Describe geology and hydrocarbon potential of

a) Krishna-Godavari basin or

b) Mumbai Offshore or

c) Cambay basin of India. **15**

6. Answer **any two** of the following : **20**

A) List and explain important duties of a wellsite geologist.

B) Describe in brief the procedure to carry out analysis of drill cuttings.

C) Explain different types of subsurface maps. How are they prepared ? How are they useful in understanding geology of the area ? To what extent computer software is useful in preparing subsurface maps ?

———————————

[3563] – 235

T.E. (Petroleum) Semester – I Examination, 2009
PETROLEUM FIELD INSTRUMENTATION AND CONTROL
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Attempt any **3** questions from **each** Section.*
*2) Figures to the **right** indicate **full** marks.*
*3) **Use** of electronic calculators, is **allowed**.*
*4) Draw **neat** sketch **wherever** necessary.*

SECTION – ONE

1. a) Describe the procedure to calibrate a Rotameter of range 1000 liters per hour. **8**

   b) Explain the term fidelity, dynamic error, speed of response and measurement lag. **4**

   c) Classify and define the characteristics of an instrument with respect to its accuracy. **4**

2. a) List various level measuring instruments. Explain any one instrument in detail used in Petroleum field application. **7**

   b) A venturimeter with throat diameter 0.065 m and coefficient of discharge 0.95 is used to calibrate a pitot static tube. Air flows through a 110 mm diameter pipe in which the venturi is fitted. The difference in water level in the manometer attached to the venturi is 50 mm. The pitot static tube is placed at the downstream of the venturi. Water manometer attached to it shows a reading of 7 mm. Calculate the flow rate through the pipe and the coefficient of velocity of the pitot tube. Assume the density of air as 1.13 kg/m^3 and that of water as 100 kg/m^3. **6**

   c) Give the principle of Thermocouple. What do you mean by J type and K type thermocouple ? **5**

3. a) Explain Pipeline instrumentation in detail. **8**

   b) Explain instrumentation involved in Drilling Operation. **8**

4. a) Explain the Lease Automatic Custody Transfer (LACT). **6**

   b) Describe any two petroleum field applications with respect to instrumentation with proper sketch. **10**

P.T.O.

SECTION – TWO

5. a) Draw a Feedback control strategy for flow control operation and explain. **8**

   b) Explain with proper transient response sketch, the characteristics of First order and Second order system. **8**

6. a) Explain the control strategy for horizontal Oil-Water separator unit. **10**

   b) Discuss the application of PLC in Petroleum industry. **8**

7. a) A tank having time constant of 1 min and area 10 m^2, the steady state inlet flow rate is 5 m^3/min. The flow rate is suddenly increased to 60 m^3/min for 0.1 min by adding 5.5 m^3 of water. Calculate the liquid level at t = 0.5 min. **8**

   b) Explain controller tuning procedure with precautions involved. **8**

8. a) Discuss the applications of SCADA system in Petroleum industry. **8**

   b) Discuss the network communication components of control system. **8**

[3563] – 234

T.E. (Petroleum) (Semester – I) Examination, 2009
PRINCIPLES OF CHEMICAL ENGINEERING – I
(2003 Course)

Time: 3 Hours Max. Marks: 100

Instructions : *1) Answer question numbers **1** or **2, 3** or **4, 5** or **6, 7** or **8, 9** or **10, 11** or **12**.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **whenever** necessary.*
*4) **Black** figures to the **right** indicate **full** marks.*
*5) Assume suitable data, if **necessary**.*
*6) **Use** of logarithmic tables, slide rules, electronic pocket calculator is **allowed**.*

SECTION – I

1. a) Describe Carnot cycle with help of diagram. Comment on its efficiency. **6**
   b) Define Internal Energy and with the help of suitable example and explain 1st law of thermodynamics. **6**
   c) Write a short note on Joule Thomson Expansion. **4**

OR

2. a) Distinguish between reversible and irreversible processes– Comment on the associated entropy change. **6**
   b) With the help of neat sketch explain working principle of 'Absorption Refrigeration Cycle'. **6**
   c) Define : Isothermal Process, Closed System. **4**

3. a) With the help of suitable diagram explain flow of compressible fluid through converging – diverging nozzle. **6**
   b) Derive the mathematical model of two phase flow of fluid through a horizontal pipe. **6**
   c) Define and provide example of : Thixotropic and Pseudoplastic fluids. **4**

OR

P.T.O.

4. a) What is NPSH ? Explain its significance. **5**

   b) With the help of neat diagram explain 'Two phase flow in a vertical pipe'. **5**

   c) Define Mach number. What is hypersonic and transonic flow ? **6**

5. a) Derive mathematical expression for the following homogeneous phase reaction occurring in stirred tank vessel operating in continuous mode.

   $$A \rightarrow B$$

   Write down the assumptions considered for the derivation. **8**

   b) Differentiate between order and molecularity of a reaction. **4**

   c) Following 1^{st} order reaction is carried out at 673 K with rate constant = 150 s^{-1}

   $$X \rightarrow Y$$

   What will be the rate of reaction at 693 K considering concentrations and other conditions remaining unchanged. [Given Data : Activation Energy for the reaction = 18750 kCal/ kmol]. **6**

   OR

6. a) Define Theoretical flame temperature and discuss its importance. **4**

   b) What is the requirement of combustion engineering in Petroleum Industries ? Explain with proper justification. **6**

   c) Differentiate space time and space velocity. **4**

   d) With the help of neat diagram show operations of batch, semi batch and continuous reactors. **4**

SECTION – II

7. a) Elaborate the volume corrections and pressure corrections required for ideal gas equation to make it applicable for real gases. **6**

   b) Write three different expressions which define P-V-T relation of real gases. **6**

   c) Write a short note on compressibility factor. **4**

OR

8. a) What is PVT behaviour of a fluid ? How is it represented graphically ? **6**

   b) With the help of phase diagram show the location of critical point and highlight its importance. **6**

   c) Write a short note on supercritical state. **4**

9. a) What do you mean by VLE data ? How it can be obtained experimentally ? **8**

   b) Define Chemical Potential and highlight its significances. **6**

   c) State Raoult's law and explain it. **2**

OR

10. a) Write down expressions of three different models of activity coefficient. **6**

    b) How bubble point of a mixture is obtained-Explain stepwise procedure. **6**

    c) Define fugacity and explain its significance. **4**

11. a) With help of phase diagram explain formation of Gas Hydrates. **8**

    b) Write advantages and disadvantages of hydrate formation. **6**

    c) Write a short note on inhibition of Gas Hydrate formation. **4**

OR

12. a) Discuss different structures of gas hydrates and explain their stability. **6**

    b) Gas hydrates is a potential source of energy - Explain. **6**

    c) Name six gases that form gas hydrates. **6**

[3563] – 233

T.E. (Petroleum Engineering) (Semester – I) Examination, 2009
DRILLING AND PRODUCTION OPERATIONS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answer **3** questions from Section – **I** and **3** questions from Section – **II**.*
*2) Answer to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is **allowed**.*
*6) Assume suitable data, if **necessary**.*

SECTION – I

1. a) Explain working of conventional core barrel. Write different uses of core samples. **8**

   b) Discuss hoisting system of a drilling rig in brief. **8**

OR

1. a) Discuss Power transmission system of an oil well drilling rig in brief. **8**

   b) Discuss different equipments and machinery at the drill site. **8**

2. a) 17.5" hole size, 2000 M deep well consist of a drill string assembly as 8" drill collar = 12 numbers, 6.5" drill collar = 6 numbers, 5" HWDP = 13 numbers. **12**

   Capacities are as follows :

   8" drill collar = 0.0252 bbls/m.

   6.5" drill collar = 0.0252 bbls/m.

   5" HWDP = 0.0287 bbls/m.

   5" Drill pipe = 0.052 bbls/m.

   Discharge of pump = 0.123 bbls/ stroke at 100% efficiency.

   Standard length of drill collar = 9.40 m.

   Standard length of HWDP = 9.27 m.

Calculate number of strokes required for bottom's up and calculate no. of strokes for one cycle if pump efficiency is 97%.

Use of following data :

i) 20" casing length 1200 m.

ii) Annular capacity between 5" D/P× 20" casing = 1.0854 bbls/m.

iii) Capacity between 17.5" open hole× 8" drill collar = 0.7721 bbls/m.
17.5" open hole× 6.5" drill collar = 0.8414 bbls/m.
17.5" open hole× 5" drill pipe = 0.8964 bbls/m.

b) Discuss types and functions of drilling fluid in brief. **6**

OR

2. a) Discuss different rheological properties of mud in brief. **8**

b) A triplex single acting pump has liner size 7", stroke length 12", pump spm = 60, efficiency of the pump is 95% **6**

Calculate : i) Actual discharge ii) Theoretical discharge iii) Slip

c) Discuss different pressure losses in drilling fluid circulation system. **4**

3. a) Explain geometry of differential stuckup in detail. Determine magnitude of differential stuckup force across a permeable zone of 9 meter. Use the following data :

i) Differential pressure = 1000 psi.

ii) Thickness of filter cake = 12.7 mm.

iii) Friction factor = 0.1. **10**

b) Discuss functions of different blow out ram preventers. **6**

OR

3. Write short note on : **16**

i) Different factors affecting rate of penetration.

ii) Discuss causes and symptoms of well kick.

SECTION – II

4. a) Discuss different uses of packers and explain setting of mechanical packer in brief. **10**

   b) Discuss different types of well completion methods. Explain open hole well completion with advantages and disadvantages in detail. **8**

OR

4. a) Explain the conventional methods of well perforation in brief. **9**

   b) Write different considerations in selection of packers. **9**

5. a) Explain in detail the effect of temperature and pressure on tubing. **8**

   b) Discuss the functions of : i) safety valve ii) sliding sleeves iii) landing nipple v) pump out plug **8**

OR

5. a) What are the different functions of cementation job. Explain primary cementation in brief. **10**

   b) Explain casing policy of an oil well with suitable sketch. **6**

6. Write short note on : **16**

   I) Tubing hanger II) Coil tubing unit

OR

6. Write short note on : **16**

   I) DST (Drill Stem Test) II) X-mas tree and choke.

———————

[3563] – 232

T.E. (Petroleum Engg.) (Sem. – I) Examination, 2009
PETROLEUM GEOLOGY – I
(2003 Course)

Time : 3 Hours Max. Marks : 100

N.B. : *1) Answer **any 3** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate books**.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) **Black** figures to the **right** indicate **full** marks.*

SECTION – I

1. A) Explain what happens when a mudstone /shale passes into a slate and phyllite. **5**

   B) What are different rock forming minerals ? **3**

   C) Draw a flow chart for the processes involved in the formation of sedimentary rocks. How are they classified ? **8**

OR

1. A) What is a chemical weathering ? Explain modes of chemical weathering. **8**

   B) How to distinguish conglomerate and breceia on the basis of texture, composition, source of sediments and origin ? **8**

2. A) Give triangular classification of mass movements based on velocity and moisture content. How are different flow deposits recognised based on moisture content and grain size variation ? **10**

   B) Write short notes on hypsographic curve. **6**

OR

2. A) Discuss characteristics of convergent and divergent plate boundaries with suitable example. **10**

   B) How is occurrence of earthquake discussed on the basis of elastic rebound theory ? **6**

P.T.O.

3. A) Describe with the help of neat sketches any one geometric classification of folds. Explain relation between wavelength and amplitude of folds with increasing or decreasing interlimb angle. **12**

   B) Distinguish between fracture, fault and fault zone. **6**

OR

3. A) Describe in brief quantitative measurements of fractures. **5**

   B) What are normal faults, reverse faults and strike-slip faults ? **8**

   C) What are tectonic joints ? Describe the terminology to classify tectonic joints associated with folds. **5**

SECTION – II

4 A) Discuss the classification of sedimentary rocks based on triangular diagram of lime- sand - clay/mud. **6**

   B) What is a bed form ? Explain how ripple marks and dunes are generated in response to velocity of water flow and size of particles. **10**

OR

4. A) What are the major constituents of carbonate rocks ? How are they classified on the basis of grain size and mud content ? **8**

   B) How is sorting of sediments interpreted using cumulative distribution and probability frequency distribution ? **8**

5. A) How foraminifera and ostracod useful in interpretation of depositional environment ? **8**

   B) Write short note on mode of preservation of fossils. **8**

OR

5. A) Explain in brief abundance and composition of phytoplankton with increasing depth of marine water. **8**

   B) What are biogenic sedimentary structures ? How are these used in interpretation of environment of deposition ? **8**

6. A) Write standard geological time scale in a tabular form with important events. **8**

   B) Give chronology of events in a tabular format for following interpreted subsurface section as shown in Fig.1 **10**

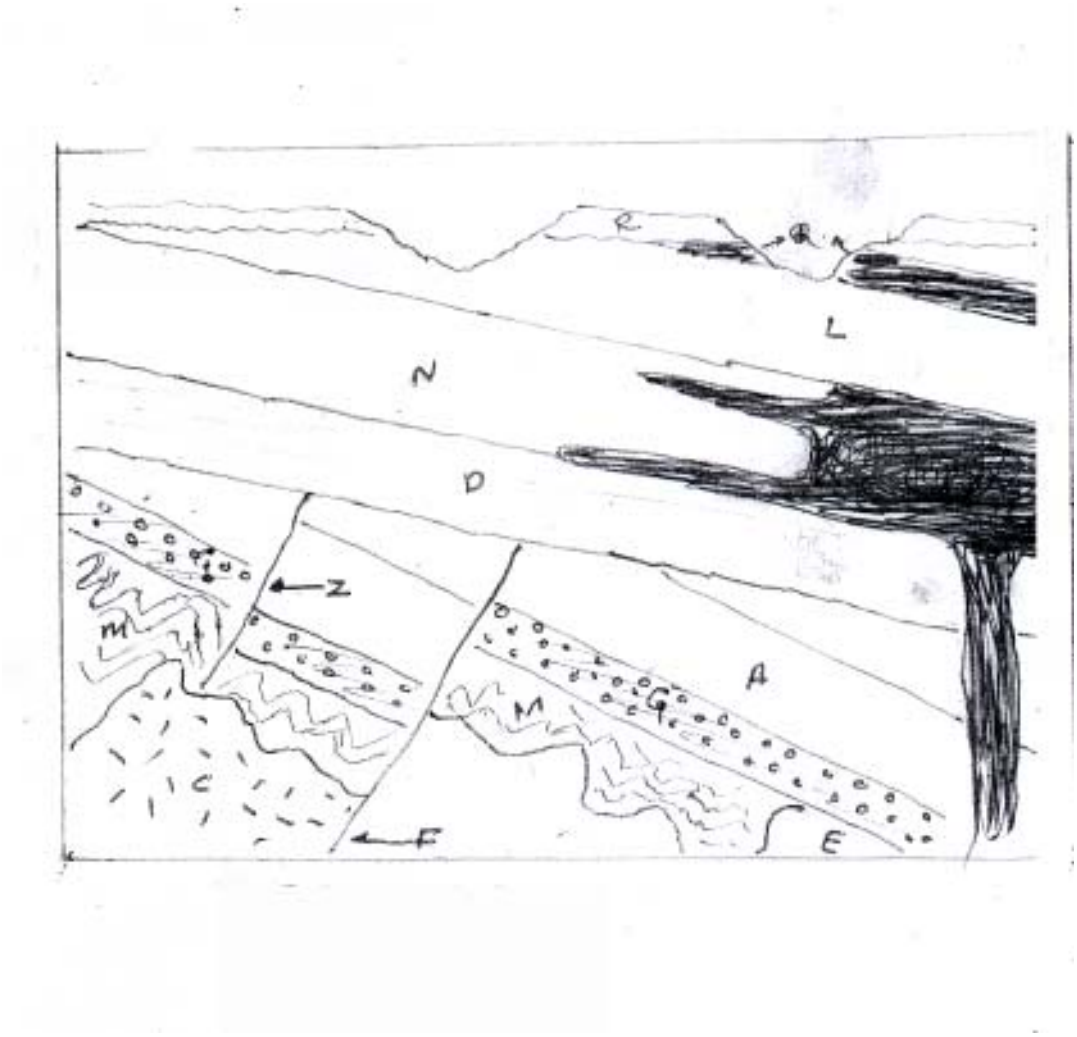


Fig. 1

OR

6. A) Describe different types of unconformities with suitable diagram. **10**

B) Reconstruct chronology of events based on emergence and submergence of coast in a sedimentary sequence encountered in preliminary investigations as shown in Fig. 2. Give brief explanations in support of your reconstruction. **8**

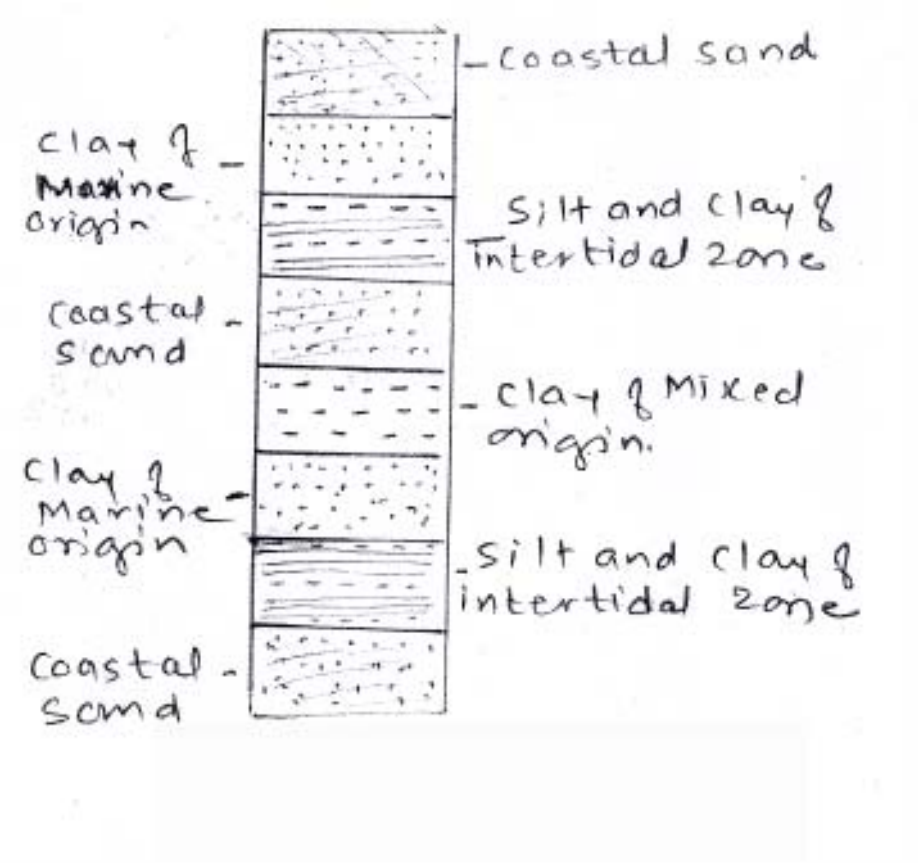


Fig. 2

[3563] – 231

T.E. (Petroleum) (Sem. – I) Examination, 2009
MATHEMATICAL METHODS FOR PETROLEUM ENGINEERING
(2003 Course)

Time : 3 Hours Max. Marks : 100

N.B. : *1) In Section – **I** attempt Qu. **1** or Qu. **2**, Qu. **3** or Qu. **4**, Qu. **5** or Qu. **6.** In Section – **II** attempt Qu. **7** or Qu. **8**, Qu. **9** or Qu. **10**, Qu. **11** or Qu. **12**.*

*2) Answers to the **two** Sections should be written in **separate** books.*

*3) **Neat** diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) **Use** of electronic pocket calculator is **allowed.***

*6) Assume **suitable** data, if necessary.*

SECTION – I

1. a) Show that u = $x\sin x \cosh y - y \cos x \sinh y$ is harmonic and find its harmonic conjugate. **6**

   b) If f (z) is analytic, show that **6**

   $$\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$$

   c) Find the bilinear transformation, which maps the points l, i, –l from z-plane into the points i, o, – i of the w-plane respectively. **5**

OR

2. a) Show that the complex function w = f (z) with constant modulus is constant. **5**

   b) Find the map of the straight line y = x under the transformation $w = \frac{z-1}{z+1}$. **6**

   c) Show that $f(z) = \sqrt{xy}$ is not analytic at origin eventhough C.R. equations are satisfied at origin. **6**

P.T.O.

3. a) Evaluate

$\oint_c \frac{\sin^6 z}{\left(z-\frac{\pi}{2}\right)^3} dz$ where 'c' is the circle $|z| = 2$ **5**

b) Find the residues at each of the poles of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ **5**

c) Evaluate $\oint_c e^z \sec z \, dz$, where 'c' is $|z| = 2$. **6**

OR

4. a) Find the residues at each of the poles of the function $f(z) = \frac{2z^2+2z+1}{(z+1)^3(z-3)}$ **5**

b) Evaluate $\oint_c \frac{4z^2+z}{z^2-1} dz$ **5**

where 'c' is the contour $|z-1| = \frac{1}{2}$.

c) Evaluate $\int_0^{2\pi} \frac{d\theta}{1-2a\cos\theta+a^2} (0<a<1)$ using Residue theorem. **6**

5. a) From a group of 10 students, marks obtained by each in papers of Mathematics and Applied Mechanics are given as **6**

x marks in Maths.	23	28	42	17	26	35	29	37	16	46
y marks in App. Mech.	25	22	38	21	27	39	24	32	18	44

Calculate Karl Pearson's coefficient of correlation.

b) On an average a box containing 10 articles is likely to have 2 defectives. If we consider a consignment of 100 boxes, how many of them are expected to have three or less defectives ? **6**

c) In a certain factory turning out razor blades, there is a small chance of $1/500$ for any blade to be defective. The blades are supplied in a packet of 10. Use Poisson distribution to calculate the approximate number of packets containing no defective and two defective blades, in a consignment of 10,000 packets. **5**

OR

6. a) Given that $\bar{x} = 8.2$, $\bar{y} = 12.4$, $\sigma_x = 6.2$, $\sigma_y = 20$ and r (x, y) = 0.9. Find x for y = 10. **6**

b) Among 64 offsprings of a certain cross between guinea pigs 34 were red, 10 were black and 20 were white. According to a genetic model, these numbers should be in the ratio 9:3:4. Are the data consistent with the model at 5% level ?

$[\Psi_2^2; 0.05 = 5.991]$ **5**

c) For a normal distribution, with mean $\bar{x} = 1$, S.D. = 3 find the probabilities for the intervals :

i) $3.43 \leq x \leq 6.19$;

ii) $-1.43 \leq x \leq 6.19$

$[z_1 = 1.73, A_1 = 0.4582; z_2 = 0.81; A_2 = 0.2910]$ **6**

SECTION – II

7. a) With usual notations establish the following : **9**

i) $(E + 1)\ \delta = 2\ (E - 1)\mu$

ii) $\delta^2 y_5 = y_6 - 2y_5 + y_4$

iii) $\left(\frac{\Delta^2}{E}\right) f(x) \neq \frac{\Delta^2 f(x)}{E f(x)}$.

b) Evaluate $\int_0^1 \frac{x^2}{1+x^3} dx$ taking $h = \frac{1}{6}$ by using **8**

i) Simpson's $\frac{1}{3}$rd rule

ii) Simpson's $\frac{3}{8}$th rule

Hence obtain the approximate value of $\frac{1}{3}\log_e^2$ in each case. Compare the results with true value.

OR

8. a) For the following tabulated data : **8**

θ	0°	5°	10°	15°	20°	25°	30°
$\tan\theta$	0.0000	0.0875	0.1763	0.2679	0.3640	0.4663	0.5774

Find the value of tan 16° using Stirling's formula.

b) For the following tabulated data : **9**

x	1.2	1.4	1.6	1.8	2.0	2.2
f(x)	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

Find the first and second derivative of the function f (x) at x = 1.2.

9. a) Evaluate $\sqrt{12}$ correct to four places of decimals by Newton-Raphson iterative method. Write algorithm for the method used. **9**

b) Use method least squares to fit a second degree parabola of the form $y = ax^2 + bx + c$ to satisfy the following data : **8**

x	1	2	3	4	5	6	7
y	– 5	–2	5	16	31	50	73

OR

10. a) Solve the following system of equations by Gauss-Seidel iterative method: **8**

$5x_1 + 2x_2 + x_3 = 12$

$x_1 + 4x_2 + 2x_3 = 15$

$x_1 + 2x_2 + 5x_3 = 20.$

b) Use Runge-Kutta method of fourth order to solve : **9**

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}; y(1) = 1$$

to find y at x = 1.2 taking h = 0.1. Write the computer algorithm for the above method.

11. a) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the pivotal points of the grid shown in the Fig. 11a. **8**

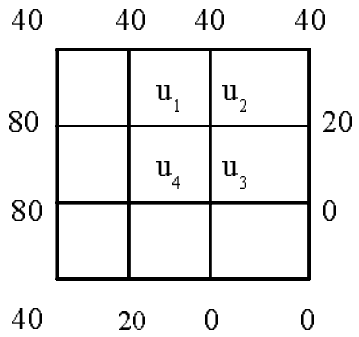


Fig. 11 a

b) Solve the following Linear programming problem by Simplex method. **8**
Minimize $z = x_1 - 3x_2 + 3x_3$

Subject to $3x_1 - x_2 + 2x_3 \leq 7$

$2x_1 + 4x_2 \geq -12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1, x_2, x_3 \geq 0.$

OR

12. a) Solve the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -500$ for pivotal values on a square plate bounded by $x = 0$, $y = 0$, $x = 3$, $y = 3$ and u is zero at the every point on the boundary of square plate. **8**

b) Solve the following Linear programming problem by Simplex method : **8**

Maximize $z = 3x_1 + 2x_2 + 5x_3$

subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0.$

———————

[3563] – 238

T.E. (Petroleum) (Sem. – II) Examination, 2009
PETROLEUM PRODUCTION ENGINEERING – I
(2003 Course)

Time : 3 Hours Max. Marks : 100

N.B. : *1) Answer Q. No. **1** or Q. No. **2**, Q.No. **3** or Q.No. **4**, Q.No. **5** or Q.No. **6**, from Section – **I** and Q.No. **7** or Q. No. **8**, Q. No. **9** or Q. No. **10**, Q. No. **11** or Q.No. **12** from Section – **II**.*

*2) Answers to the **two** Sections should be written in **separate** books.*

*3) Neat diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) Use of logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

*6) Assume **suitable** data, **if** necessary.*

SECTION – I

1. a) A producing well gave following test data. Draw the IPR curve for this well, assuming that below bubble point it follows Fetkovich's equation. **12**

Flowing bottom hole pressure of 2400 psia at liquid rate 415 STB/day. Static reservoir pressure is 4500 psia and bubble point pressure is 2100 psia.

b) Draw the phase diagram for a typical hydrocarbon system. Indicate all the features of this diagram. Also explain in brief, meaning of 'undersaturated oil' and 'Saturated oil'. **6**

OR

2. a) For a Pseudo-steady state flow, construct IPR in a saturated oil reservoir using Vogel's equation. **12**

Porosity = 0.18, Effective permeability = 8 md pay zone = 50 ft. reservoir pressure = 5200 psia Bubble pt. pressure = 5200 psia. Fluid viscosity = 1.6 Cp Fluid formation volume factor = 1.1

Total Compressibility = 0.0000129 psi^{-1}. S = 0. drainage radius = 2800 ft. γ_w = 0.328 ft.

P.T.O.

b) Explain only graphically, **6**

i) Reservoir oil viscosity Vs Reservoir pressure (including bubble point pressure).

ii) Reservoir performance curves for water drive mechanism.

3. a) Define, bubble flow, slug flow and mist flow. **6**

b) Refer fig. I (Bean performance chart) and calculate the GLR for a well producing through a ¼ - inch choke at 100 bbls/day with a THP of 150 psi. Also calculate the GLR using empirical formula. **10**

What would be the GLR values if all other things being equal. The choke size were $^{17}/_{64}$ inch ?

Write the comparative remarks on above findings.

OR

4. A well is completed from a payzone 5600 ft to 6000 ft. The well has a static pressure of 2800 psi and P.I. of 0.365 STB/day/psi and produced with GLR of 400 Cu.ft/bbl. Tubing sizes available are 2.875" and 3.5". Select the optimum tubing size which can run near the upper boundary of payzone if it is to be operated at THP of 200 psi (Refer fig. II) **16**

5. a) Write and explain the properties that are ideally desired in a fracturing fluid. **6**

b) Predict the maximum expected surface injection pressure using following data, for the fracturing job, at a depth of 10,500 ft. **5**

Sp. gravity of fracturing fluid = 1.12

Viscosity of fracturing fluid = 18 Cp

Tubing inner diameter = 3.0 inch

Fluid injection rate = 15 bpm.

c) Draw and explain in brief the surface readout of hydraulic fracturing job, i.e the generic nature and features of pressure Vs volume rate of fluid pumped in. **5**

OR

6. a) Define the following : **6**

   i) Dissolving power of acids

   ii) Acid volume requirement

   iii) Acid injection pressure.

   b) Explain in brief the basis for selection of a well stimulation job. How do you understand the improvement in skin factor after fracturing/acidizing ? **6**

   c) Calculate the volume of calcite ($CaCO_3$) to be removed from a sandstone reservoir with a porosity of 0.22, containing 14% volume percentage of $CaCO_3$. The radius of wellbore is 0.328 ft and acid treatment region is 1.5 ft beyond the wellbore radius Payzone thickness is 10 ft. **4**

SECTION – II

7. a) Indicate the gas production and preferential water flow in a neat schematic sketches, on account of channeling behind the casing, coning and change in permeability near the wellbore. **8**

   b) Explain, how you will handle the high gas cut problem by various techniques. **6**

   c) Write the exact benefits of horizontal wells over vertical wells from the point of well productivity and workover problems. **4**

OR

8. a) Draw the schematic sketches and show gravel placement method for any one type of gravel pack completion. Indicate all the features of this sketch. **8**

   b) Draw the graph and explain the method of gravel size and screen size determination using the standard correlations for the design of a sand control job. Write the stepwise exact procedure with correlation. **10**

9. a) Design a three phase vertical separator using the following data : **12**

   Separator using the following data

   Q_o = 5000 STB/day

   Q_w = 1000 STB/day

   Q_g = 1.5 MM SCF/day

P = 410 psia, T = 110°F, $\gamma_w = 1$

$\gamma_g = 0.6$ and API gravity = 35°

Retention time for oil and water is 10 and 13 minutes respectively

Droplet size = 450 microns

The Slenderness ratio between 2 and 3 may be selected. μ = 3 Cp.

Given values of K and Z are 0.22 and 0.925 respectively.

b) Write a note on, 'devices for initial separation', inside an oil and gas separator. **4**

OR

10.a) In the gravity settling section, how will you determine the terminal settling velocity of droplet ? Explain. **4**

b) Design a vertical 2 phase separator with the following data **12**

Q_0 = 5000 bbls/day, γ_g = 0.7

Q_g = 6 MMSCF/day

P = 600 psi

T = 80°F

°API = 40°

Size of liquid droplet to be settled in, is 100 microns. Assume slenderness ratio of 3, 3.5 and 4.

Retention time is 2, 2.5 and 3 minutes.

Given values of 'K' and 'Z' are 0.26 and 0.89 respectively.

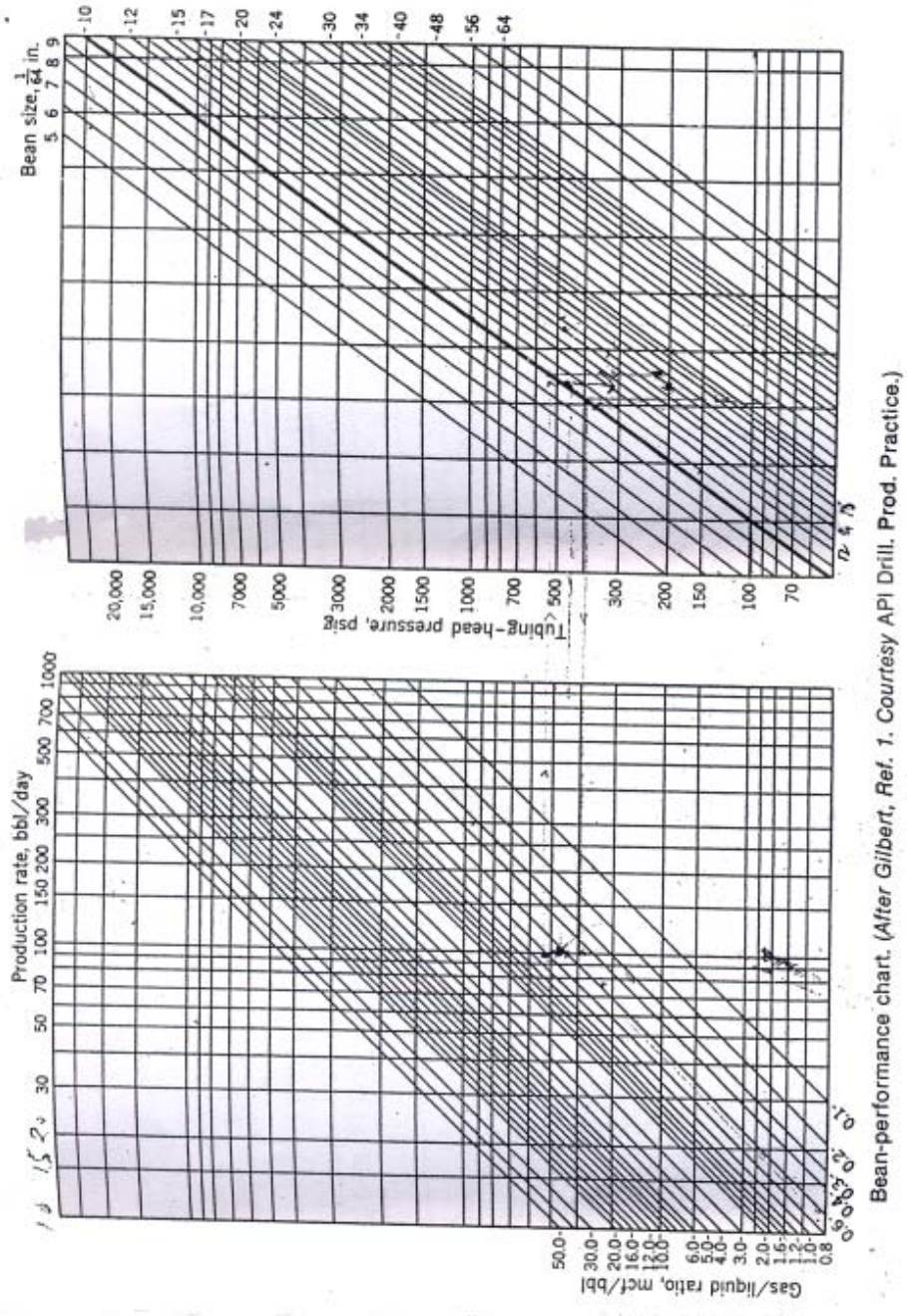
11. a) What is the purpose of a skimmer tank ? Draw the schematic sketch of a vertical and horizontal skimmer tank and explain the principle and working mechanism of these treating systems. **12**

b) Write a note on , 'Safety aspects during separation and processing of oil and gas'. **4**

OR

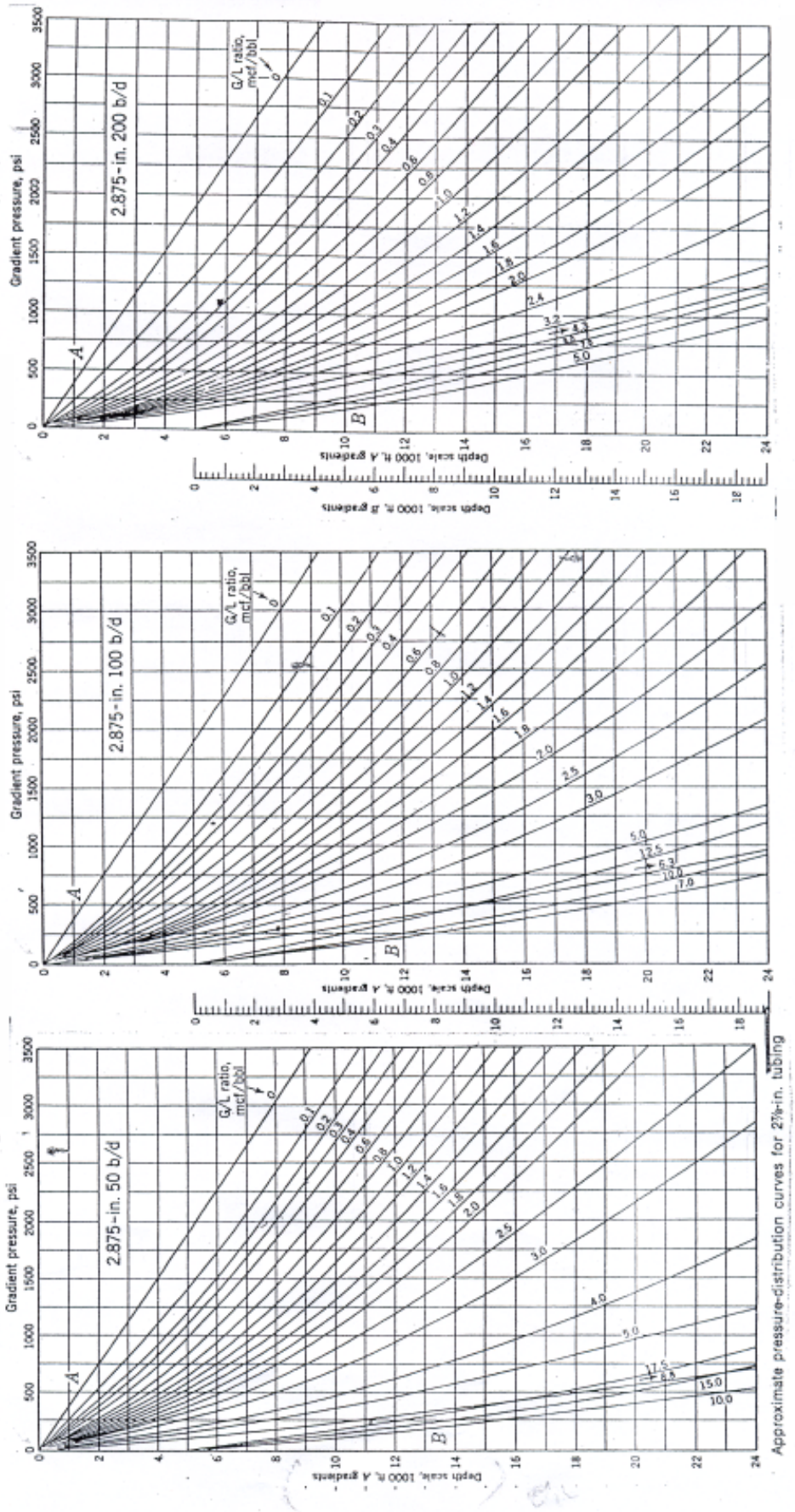
12. a) Draw the neat schematic sketch and explain the working of vertical treater. **8**

b) Describe the general procedure and design considerations for sizing a vertical or horizontal treater in brief. **8**

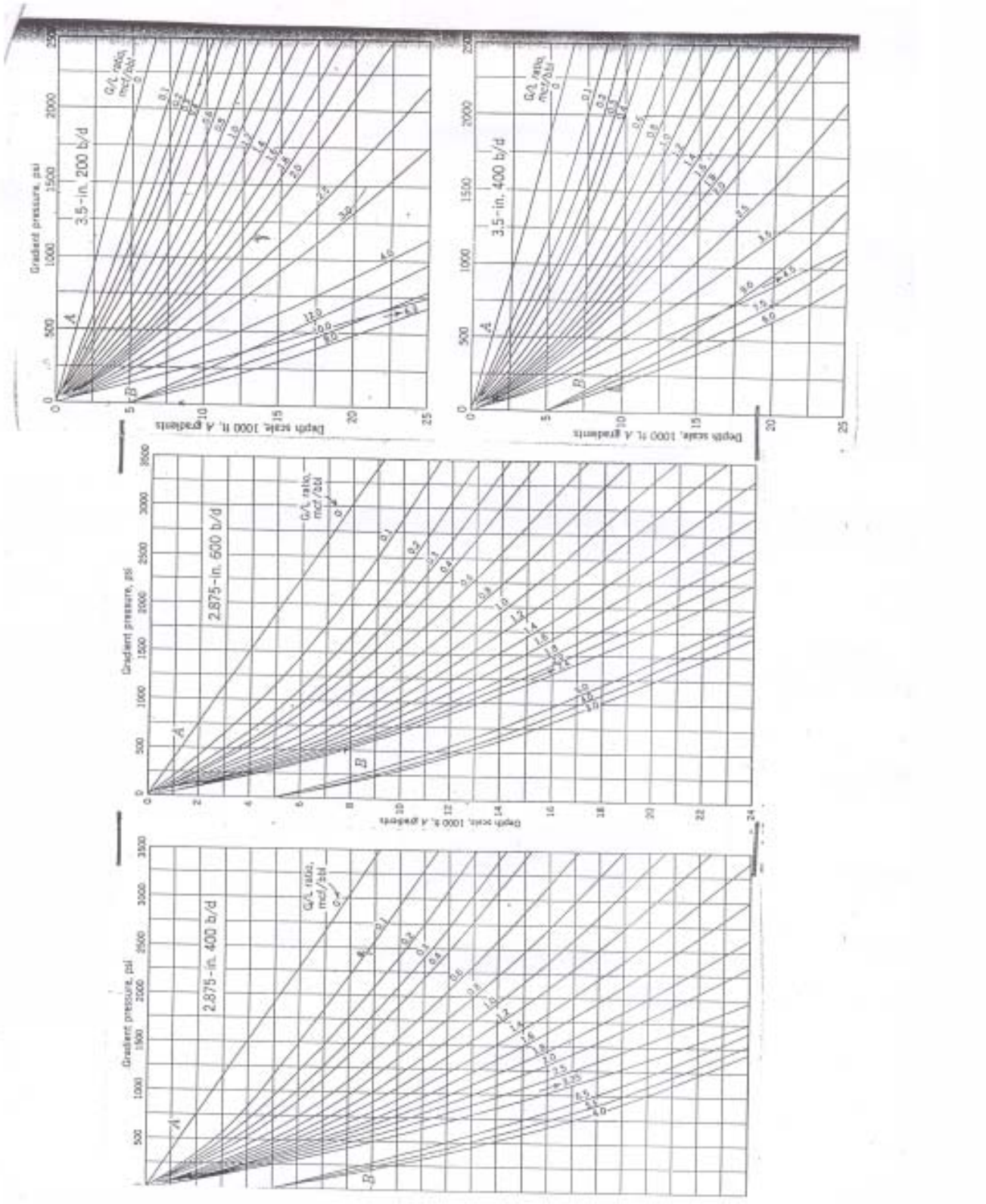


Bean-performance chart. (*After Gilbert, Ref. 1. Courtesy* API Drill. Prod. Practice.)

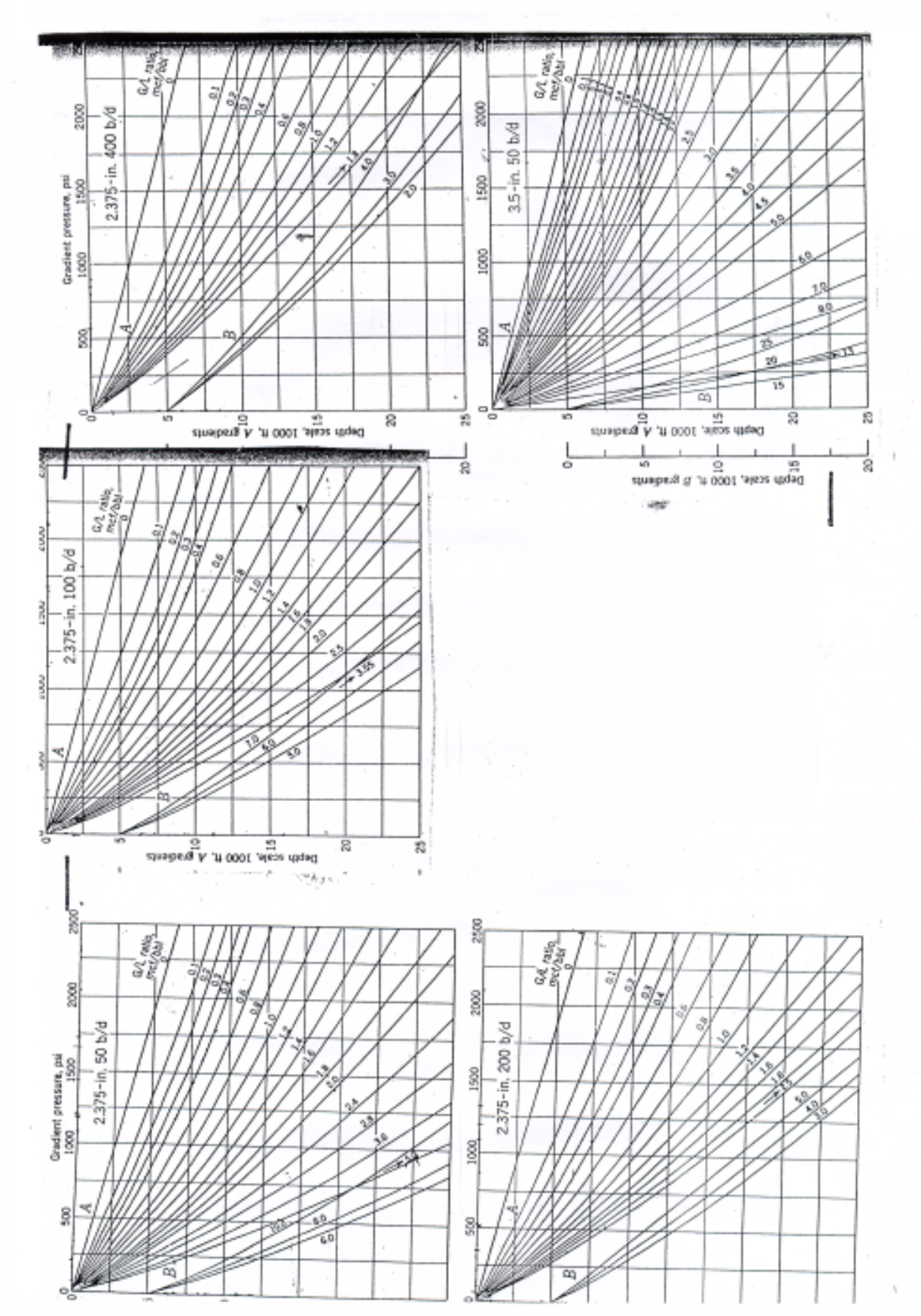
Q. 3 (b)
Fig. I


2.875-in. 200 b/d
2.875-in. 100 b/d
2.875-in. 50 b/d
Gradient pressure, psi
G/L ratio, mcf/bbl
Depth scale, 1000 ft, A gradients
Depth scale, 1000 ft, B gradients
A
B
Approximate pressure-distribution curves for 2⅞-in. tubing

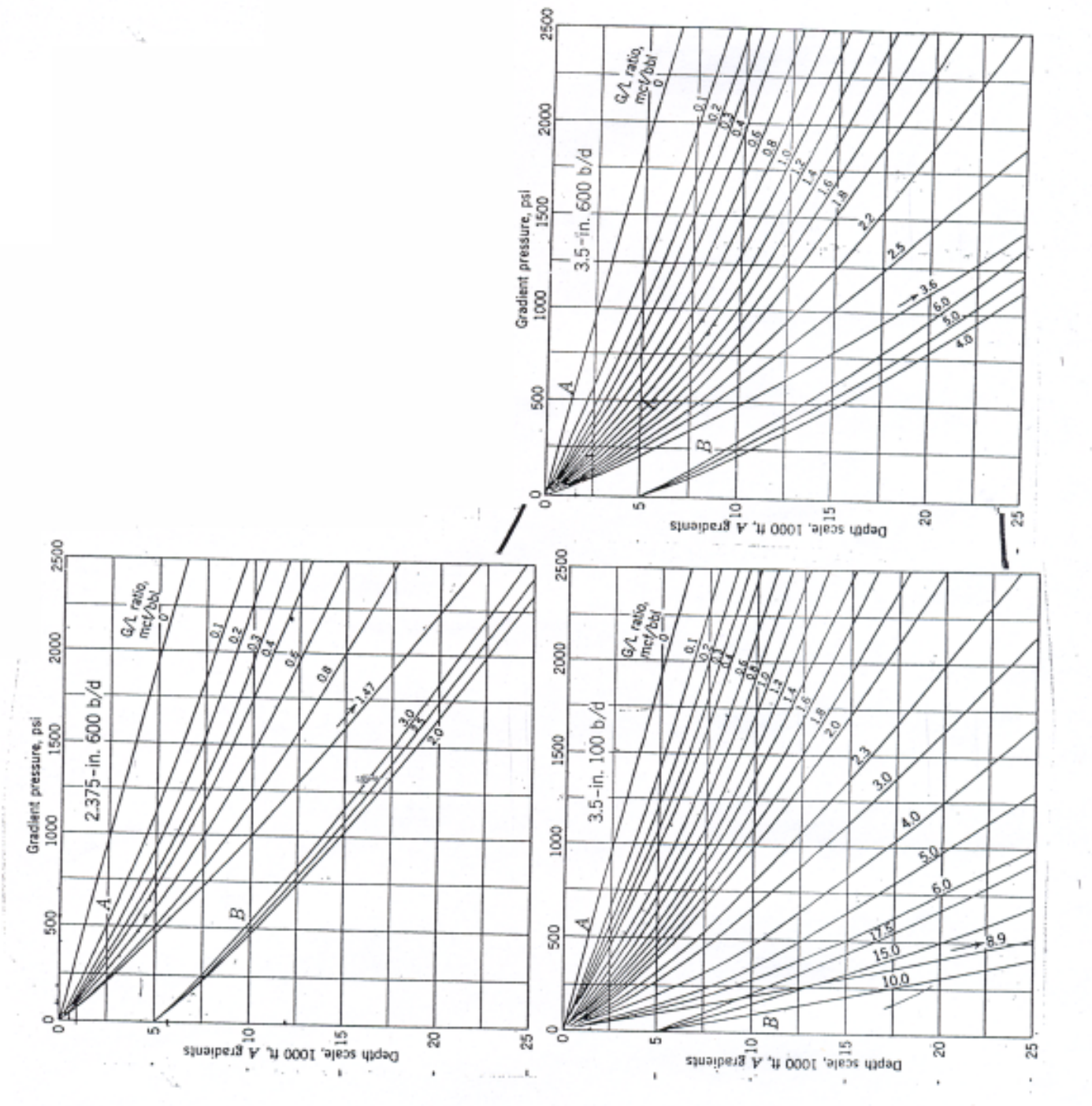
Q. 4 Fig. II


3.5-in. 200 b/d
3.5-in. 400 b/d
2.875-in. 600 b/d
2.875-in. 400 b/d
Gradient pressure, psi
Depth scale, 1000 ft, Δ gradients
G/L ratio, mcf/bbl
A
B

Q. 4
Fig. II


2.375-in. 400 b/d
3.5-in. 50 b/d
2.375-in. 100 b/d
2.375-in. 50 b/d
2.375-in. 200 b/d
Gradient pressure, psi
Depth scale, 1000 ft, Δ gradients
Depth scale, 1000 ft, β gradients
G/L ratio, mcf/bbl
A
B

Q. 4
Fig. II


Gradient pressure, psi
Depth scale, 1000 ft, Δ gradients
G/L ratio, mcf/bbl
3.5-in. 600 b/d
2.375-in. 600 b/d
3.5-in. 100 b/d
A
B

Q. 4
Fig. II