P1267

[3564] - 309
B.E. (Petroleum Engineering)
FORMATION EVALUATION
(2003 Course)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Answers to the questions of both the sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Draw neat diagrams wherever necessary.***

SECTION - I

Q1) Describe borehole environment with the help of a neat sketch. Explain the empirical relationship between different zones and fluids. **[15]**

OR

Differentiate neutrons on the basis of their energies. Describe different types of sources used in neutron logging. Explain the principle of any one type of neutron logging tool with the help of a sketch.

Q2) Explain important resistivity logging methods with the help of neat sketches. **[15]**

Q3) Write notes on any four of the following: **[20]**

a) Logs used to measure geometry of borehole,

b) Cement Bond Log,

c) Downhole fluid sampling as a part of formation evaluation,

d) Parameters measured in mud logging,

e) M.W.D.,

f) Self potential log.

SECTION - II

Q4) Outline the procedure for determination of water saturation using logs. **[20]**

OR

Write notes on any four of the following:

a) Applications of dipmeter logging,

b) Waxman and Smit Model,

c) Origin of over pressure,

d) Recognition of fractured reservoir,

e) Bullet Perforation,

f) Density Log.

Q5) What is production logging? Explain important production logging methods. **[15]**

OR

Explain the importance of core analysis. Explain 'special core analysis'. How does it help in formation evaluation?

Q6) How will you recognize various depositional environments using logs. Explain with appropriate sketches. **[15]**

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P1266

[3564] - 308
B.E. (Petroleum Engineering)
PETROLEUM EXPLORATION
(2003 Course)

Time : 3 Hours] ***[Max. Marks :100***

Instructions to the candidates:

1) ***Answers to the questions should be written in separate answer books.***
2) ***Neat diagrams should be drawn wherever necessary.***
3) ***Assume additional data, if necessary.***
4) ***All questions are compulsory.***

SECTION - I

Q1) What are the important geophysical methods used in oil exploration. Write in brief about each such method. Compare geophysical methods and geochemical methods. **[16]**

OR

a) Explain the data processing and corrections applied in gravity method of exploration. **[8]**

b) The gravity reading at point B on the 660 m high plateau is 981362.57 m Gal, while the reading at point C far away is 981430.14 m Gal. The density of the subsurface rocks is the same throughout the region. Find the density of the rock making up the plateau. (Draw a rough sketch). **[8]**

Q2) Answer any two of the following: **[16]**

a) Trace briefly, how the oil exploration activities have changed historically with the advancement of technology.

b) Describe the principles, construction and working of any one type of magnetometer and give methods to reduce the data.

c) Explain with the help of neat sketches two commonly used configurations in electrical surveys.

OR

a) Explain different nonexplosive energy sources used in seismic surveys. **[8]**

b) Describe the operations carried out in field while carrying out field seismic reflection surveys. **[8]**

P.T.O.

Q3) a) Explain the theory of micro seepages. **[14]**

b) How does weathering of petroleum take place in surface and in subsurface? **[4]**

OR

Write notes on <u>any two</u> of the following: **[18]**

a) Direct detection of hydrocarbons,

b) Basin evaluation with respect to petroleum prospecting,

c) Geochemical correlation methods.

SECTION - II

Q4) Explain the techniques used for seismic reflection data processing. **[16]**

OR

Write notes on <u>any four</u> of the following: **[16]**

a) Noise in seismic data,

b) Classification of drilling locations,

c) CDP shooting,

d) Derivation of an expression for magnetic anomaly over a faulted horizontal slab,

e) Concept of seismic facies,

f) Gravity anomaly.

Q5) Write detailed notes on <u>any two</u> of the following: **[16]**

a) 3 D and 4 D seismic studies in reservoir zones,

b) Seismic stratigraphy,

c) Salient features of exploration in stratigraphic traps,

d) Prognostication of reserves.

Q6) Explain in brief any three methods of reserves estimation and categorization. How are they useful in different stages of oil exploration? **[18]**

OR

Write notes on <u>any three</u> of the following: **[18]**

a) Integrated approach towards exploration in marginal fields,

b) Risk analysis in oil exploration,

c) Unconventional hydrocarbon resources.

❄❄❄

Total No. of Questions : 12] **[Total No. of Pages :6**

P1337

[3564] - 316
B.E. (Petroleum)
OIL WELL DRILLING ENGINEERING
(2003 Course) (New) (412390)

Time : 3 Hours] ***[Max. Marks:100***

Instructions to the candidates:

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) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain in brief, how well planning objectives and GTO vary with different types of wells. List the general stages involved in well planning. **[6]**

b) Use the common and specific case data given below and find out the case of minimum drilling cost. Also state how will you optimize the cost for optimum bit weight and rotary speeds, if rotating / drilling time-cost is operating cost, bit and trip cost is to be considered as fixed cost. **[6]**

Data :

Rig cost = $ 4000/hr

Bit cost = $ 50,000/-

Trip time = 6.5 hr.

	Bit weight 1b	Rotary speed rpm	Drilled footage ft	Rotating time hr.
Case 1	75,000	127	149	5.06
Case 2	65,000	92	192	8.65
Case 3	65,000	65	217	12.28

c) A rig must hoist a load of 1,90,000 1bf. The drawworks can provide a maximum input power of 850 hp. Ten lines are strung between the crown block and the traveling block and the dead line is anchored to a derrick leg on one side of V – door. **[6]**

P.T.O.

i) Calculate the static tension in the fast line when upward motion is impending.

ii) Calculate the maximum hook horsepower available.

iii) Calculate the maximum hoisting speed.

iv) Calculate the derrick load when upward motion is impending.

v) Calculate the maximum equivalent derrick load.

vi) Calculate the derrick efficiency factor.

OR

Q2) a) Write short notes on the following : **[10]**

i) Drilling cost predictions.

ii) Tonne Mile Calculations.

b) i) How many drill collars should be run if the maximum weight on bit is anticipated to be 20 tonne, the average drill collar length is 9.2 m, the drill collar weight is 0.218 tonne / mtr., and the buoyancy factor of mud is 0.847. **[3]**

ii) Collapse pressure at 2,460 m is to be calculated due to a fluid column of sp. gravity 1.6 acting externally on a drill pipe. If the collapse resistance of 'E' grade drill pipe is 335 kg/cm^2; can we run the drill pipe empty during DST? Calculate the length of water cushion required inside the drill pipe if, it should not be run empty.**[5]**

Q3) a) Determine pump pressure for following hydraulic system. Also prove that, flow inside drill collar is turbulent and outside is laminar. Data given: **[12]**

i) Length of 5" D/P = 9643 ft ID = 4.276 inch.

ii) Length of 6.5" D/C = 278 ft ID = 2.815 inch.

iii) Well depth = 3100 m contains 9 5/8" casing upto 2323 m.

iv) PV = 6 CP, Yield point = 25 1B/100 ft^2.
Mud Density = 10.16 ppg.

v) Flow rate = 436.4 gpm.

vi) Open hole = 8.5 inch.

vii) Jet / Nozzle size = 13/32. Number of nozzles = 3.

viii) Surface equipment pressure loss = 27.36 psi.

ix) Pressure loss inside drill pipe and drill collar in psi =
$(8.91 \times 10^{-5} \times \rho^{0.8} \times Q^{1.8} \times PV^{0.2} \times L) / D^{4.8}$.

x) Annular pressure loss against drill pipe in cased hole is 270.66 psi and open hole is 79.17 psi.

xi) Annular pressure loss against drill collar = 21.56 psi. The general critical velocity equation is,

$$Vc = \frac{97\ PV + 97\ \sqrt{(PV)^2 + 8.2\rho\ D^2\ YP}}{\rho\ D}\ ft/min.$$

b) List the various factors affecting rate of penetration during drilling and explain any one in detail. **[4]**

OR

Q4) Prior to pulling out of hole, the following was recorded. **[16]**
Pump pressure is 2200 psi at normal flow rate of 280 gpm.
Pump pressure is 700 psi at slow flow rate of 150 gpm.
Drill pipe size = 4½ inch x 16.6 1b/ft..I.D.=3.826".
Mud weight = 9.5 ppg. Jet size = 9-10-10.
Depth = 10,000 ft. Critical flow rate = 320 gpm.
Bit size = 8.5 inch.
Determine the proper 3 jet sizes and flow rate for maximum impact. Desired pump pressure is 2400 psi.
Calculate the % BHHP at 10,000 ft and 12,000 ft.

Q5) Explain geometrical planning of Type-I (L-shape) directional well and using following data, find co-ordinates of type-I well **[16]**
Slot Co-ordinate 15.32ft.N, 5.06 ft.E
Target Co-ordinate 1650 ft.N, 4510 ft.E
TVD Target=9890 ft.
TVD KOP = 1649 ft.
Build up rate = 1.6 per 100 ft.

OR

Q6) a) Derive equation for minimum horizontal stress as, **[8]**

$$\sigma_n = \left(\frac{\gamma}{1-\gamma}\right)\sigma_v$$

Final vertical and horizontal stresses at a depth of 10,000 ft. Assume Poisson's ratio = 0.26, overburden gradient 1 psi/ft.

b) Write short note any two : **[8]**

i) Torque & drag.

ii) MWD Tool.

iii) Radius of Curvature Method.

SECTION - II

Q7) a) Discuss how abnormal pressure develops in the formation. Explain 'd' exponent and find out pore pressure using 'd' exponent values. Data given: **[10]**

i) Normal pore pressure gradient = 1.48

ii) Observed value of d_c = 1.6

iii) Normal Trend value dc_n=1.75

iv) Overburden gradient = 2.36

b) 5.5"Liner, 17 ppf, N80 has a collapse resistance / rating of 6280 psi. What will be collapse resistance / rating with an axial tensile load of 94,486 lbs.? Pipe body yield strength of N80 liner is 3,97,000 lbs. **[2]**

Collapse curve factor	Biaxial component
X	Y
0.238	0.911
0.236	0.912

c) 600 ft/ of 13 3/8" surface casing is to be set in 16" hole. The slurry yield is 1.18 cubic ft/sack & 75% excess is needed. The cement slurry weight is 15 ppg & requires 5.2 gal/sack of water. Cement is circulated to the surface. Capacity of the annulus to be cemented is 0.42305 cubic ft/ft. Capacity 13 3/8" Casing is 0.1497 bbl/ft. Calculate i) No. of sacks ii) volume of water in bbl & in litrs. iii) Displacement volume. **[6]**

OR

Q8) a) Using following data, calculate pumping rate required to put cement slurry into turbulent flow in the annulus. **[4]**

Hole size 8.5"

Casing size 5.5"

Cementing depth 5000ft.

Type of slurry API Class 'H' cement

I.D. of 5.5 casing is 4.60"

n' = 0.30 k"= 0.196 ρ = 15.7 lb/gal

b) Find 9 5/8" casing shoe depth using following well data. **[14]**

(Use graphical method)

Depth (m)	Formation Pressure in M.W.E.	Fracture gradient in M.W.E.
500	1.05	--
1500	1.05	1.55
2100	1.05	1.64
2500	1.20	1.78
3000	1.40	1.96
3400	1.70	2.13
3700	1.80	2.21
4000	1.825	2.30

Check above 9 5/8" shoe depth with respect to differential stuck up & kick tolerance.

Q9) a) Explain wait & weight method of well control in detail. **[8]**

b) A 3000 psi BOP control unit has 18, ten gallons capacity accumulator bottles. How many gallons of usable fluid is available with 1200 psi minimum operating pressure? **[2]**

c) While pulling out driller forgot to fill the hole & 40 stands of drill pipes were pulled out dry. What will be the reduction in bottom hole pressure? Calculate with the following data. **[4]**
Well depth 9200 ft (TVD). Casing shoe 5240 ft (TVD)
Mud weight 13.8 ppg
Open hole capacity 0.1482 bbl/ft.
Casing capacity 0.1611 bb1/ft
Drill pipe metal displacement 0.0076 bb1/ft
Length of one stand 93 ft.

d) Write different causes of well kick. **[2]**

OR

Q10) Hole size – 12.25". Hole depth 6000 ft TVD **[16]**
Casing : 13-3/8" set at 4800 ft TVD
Drill pipe : 5" Capacity 0.0176 bbls/ft
Drill collar : 8.(O.D./I.D)3", 530 ft long, capacity 0.0087 bbls/ft
Mud wt. : 11.4 ppg
Capacities :
Drill collar in open hole : 0.0836 bbl/ft
Drill pipe in open hole : 0.1215 bbls/ft
Drill pipe in casing : 0.1353 bbls/ft

Mud pump output = 0.119 bbls/stroke
Slow circulation rate = 440 psi at 30 SPM
SIDP = 340 psi
SICP = 410 psi
Pit gain = 12 bbls.
Calculate,

a) How many strokes required to pump kill mud from surface to bit & bit to surface
b) Kill mud density
c) Initial circulating pressure
d) Final circulation pressure
e) Time for one complete circulation.
f) Plot step down plan for driller's method
g) Total annular volume.

Q11) a) Explain purpose of testing BOP & discuss function testing of BOP in detail. **[8]**

b) Discuss different types of offshore rigs with suitable sketches & compare them. **[8]**

OR

Q12) Write short notes on : **[16]**

a) Subsea well head assembly.
b) Rig move operation of a Jack up rig
c) Drilling operation on floater rig
d) BOP hydraulic control unit.

Total No. of Questions : 8] **[Total No. of Pages : 3**

P1313

[3564]-310
B.E. (Petroleum Engineering)
NATURAL GAS ENGINEERING
(2003 Course)

Time : 3 Hours] ***[Max. Marks : 100***

Instructions to the candidates:

1) ***Answers to the two sections must be written in separate answer books.***
2) ***Answer three questions from each section.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams should be drawn wherever necessary.***
5) ***Use of a non-programmable calculator is allowed.***
6) ***Assume suitable data if necessary and clearly state it.***
7) ***Graph of z factor attached.***

SECTION - I

Q1) a) Calculate the reserves in a gas field of 2000 acres, with 20 ft sand thickness, 15% porosity, 15% water saturation, BHP = 3000 psi gauge, BHT = 200 F. The natural gas has the following weight composition: $C_1 = 0.85$, $C_2 = 0.05$, $N_2 = 0.1$. **[6]**

b) Find viscosity, molecular weight, specific gravity, pseudo critical properties, Z factor, Bg. Gas data : Pci, Tci are: 668, 708, 493 psia; 343, 550, 227 R. ωi and μi are 0.01, 0.09, 0.04 and 0.001, 0.002, 0.0015 cp respectively. Explain the charts you use to correct for water?
Draw the graph of viscosity and z factor versus pressure. **[10]**

Q2) What is an inflow performance curve for a gas reservoir? What is an outflow performance curve? What is a tubing intake curve? Plot all on the same graph? What is the usefulness of this graph? Explain in detail with equations. **[16]**

Q3) For the well with the following parameters; depth of 5790ft, gas gravity is 0.6, Pts = 2300 psia, and average temperature of the flow string is 117 F-, Gas flow rate = 5MMscfd, D = 2 inches, Twf = 160 F, Ttf = 83 F, Ptf = 2122 psia, Length of tubing = 5700 ft, well is vertical. State your assumed values clearly and only do one iteration to find the flowing bottom hole pressure, and temperature and static bottom hole pressure. Tpc = 358 R, Ppc = 672 psia, f = 0.015, z = 0.82. **[18]**

P.T.O.

Q4) Explain all the constants in the gas flow meter equation. **[16]**

SECTION - II

Q5) a) What is the criteria for choosing a CO_2 removal process?

b) Draw a process flow diagram showing the removal of carbon dioxide. **[16]**

Q6) a) With the following data, find the flow rate of the gas in cft/hr.Tb = 520 R, Pb = 14.7 psia, P_1 = 400 psia, P_2 = 200 psia, d = 10 in, T = 520 R, L = 20 miles, gas gravity = 0.6, Z = 0.9, e = 0.0006 in. **[6]**

b) If half the section of the pipeline diameter is doubled, find theoretically what happens to the flow rate. **[10]**

Q7) a) Draw a diagram of a centrifugal compressor and name its parts. **[10]**

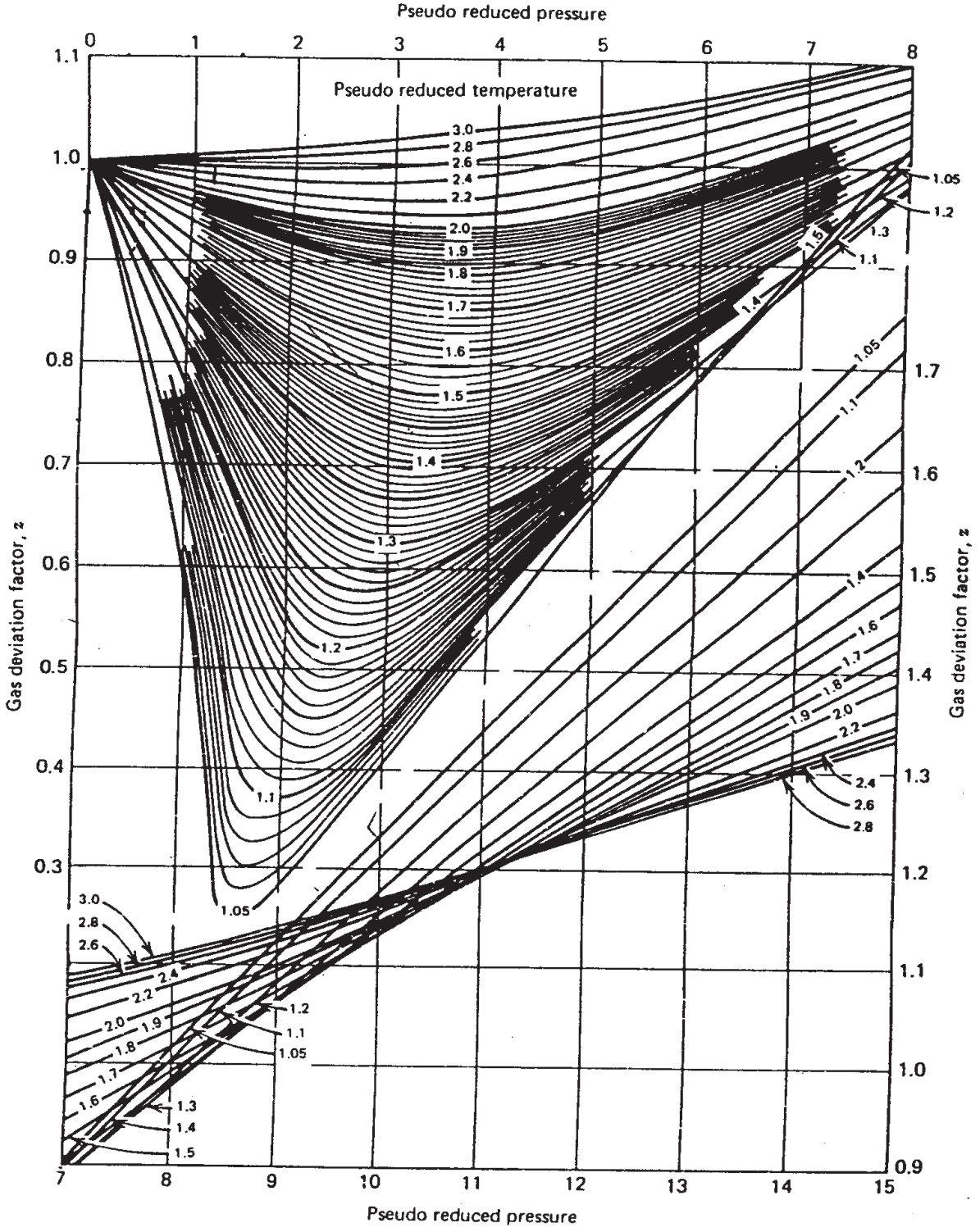
b) Write a note on reciprocating compressors. **[6]**

Q8) Write short notes on : **[18]**

a) Pipelines.

b) Mollier charts in compressor design.

c) Gas well testing.


Pseudo reduced pressure
Pseudo reduced temperature
Gas deviation factor, z
Gas deviation factor, z
Pseudo reduced pressure
3.0
2.8
2.6
2.4
2.2
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.05

Total No. of Questions : 6] **[Total No. of Pages : 3**

P1218 **[3564] - 319**

B.E. (Petroleum Engineering)
DEEP WATER TECHNOLOGY
(2003 Course)

Time : 3 Hours] ***[Max. Marks : 100***

Instructions to the candidates:

1) ***Answer 3 questions from Section - I and 3 questions from Section - II.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***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

Q1) a) Describe linear wave theory of fluid particle motion in detail. **[9]**

b) Calculate new KG if floating vessel displacement is 18600 tons and KG 68 ft. If 215 tons of excess casing at VCG of 115 ft. were offload (removed) from vessel. **[4]**

c) Discuss various motions and types of forces acting on an offshore floater rig. **[5]**

OR

a) Discuss API recommendation for subsea BOP accumulator capacity. Find number of 11 Gallon (1 gallon for rubber bladder + 10 gallons for hydraulic fluid) accumulator bottles for Open-close stack function with 50% safety factors. Fluid volume requirement for accumulator Is as follows. **[9]**

	No. of units	Volume per function (gallons)
Ram close	4	24.9
Ram open	4	24.0
Annular close	1	37.0
Annular open	1	51.5
Kill & Choke Valve open	6	1.4
Kill & Choke Valve close	3	0.9

b) Discuss 26″ drilling and 20″ casing operation in deepwater oil well. **[9]**

P.T.O.

Q2) a) What do you mean by station keeping? Describe dynamic positioning system & sources of error in D.P. system. **[10]**

b) What is offset? Discuss drive off / drift analysis in brief. **[6]**

OR

a) Discuss following riser components in detail. **[12]**

i) Lower flex or ball joint.

ii) Mud boost line.

iii) Telescopic slip-Joint.

b) Discuss riser design considerations in brief. **[4]**

Q3) a) Discuss well construction & planning of deepwater drilling. **[8]**

b) Find value of back pressure, initial value of back pressure during cementation of 7″ casing in a gas well. **[4]**

Use the following data.

i) 7″ casing depth = 2500 m.

ii) Cement rise 1500 m from surface.

iii) Sp. Gravity of mud 1.63 gm/cc.

iv) Formation pressure at the top of the productive zone = 2380 m is 39.0 MPa.

c) Discuss the problem of narrow mud window in deepwater drilling in brief. **[4]**

OR

a) Write a short note on **[8]**

i) Gas hydrate.

ii) Advantages and disadvantages of synthetic oil base mud in HPHT wells.

b) Discuss liner cementation in detail with suitable sketch. **[8]**

SECTION - II

Q4) a) Explain stage separation of an oil & gas in details. Compare horizontal and vertical Separators in brief. **[10]**

b) Discuss different types of platforms and forces while designing the platform in detail. **[8]**

OR

a) Describe offshore pipeline design considerations in brief. **[9]**

b) Explain the design considerations for offshore storage of oil & gas. **[9]**

Q5) a) Discuss different factors consider for designing cement slurry in deepwater offshore wells. Discuss strength retrogression in brief. **[8]**

b) Write different type of subsea tree & explain working principle in brief. **[8]**

OR

a) What is hydraulics? What are the objectives of rig hydraulics related to deepwater well? **[8]**

b) Write various subsea production systems and discuss selection criteria. **[8]**

Q6) Write short note on **[16]**

a) Logistic support and transportation in deepwater project.

b) Enhance oil recovery methods.

OR

Write short note on **[16]**

a) Subsea completion.

b) Subsea BOP stack & riser system.