UNIVERSITY OF PUNE
[4363]-229
T. E. (Petroleum) Examination - 2013
Natural Gas Engineering (2008 Course)

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

Instructions:

1. *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from Section I and Q7 or Q8, Q9 or Q10, Q11 or Q12 from Section II*
2. *Answers to the two sections should be written in separate answer-books.*
3. *Figures to the right indicate full marks.*
4. *Neat diagrams must be drawn wherever necessary.*
5. *Use a non programmable calculator.*
6. *Assume suitable data, if necessary and clearly state it*

SECTION -I

Q.1	A	Draw the graph of viscocity, Bg, Cg and Z factor versus pressure and explain?	6
	B	Explain the chart you use to correct gas properties for N2 impurities?	5
	C	Calculate the reserves in a gas field of 2000 acres, with 20ft sand thickness, 15% porosity, 15% water saturation, BHP=3000 Psi Gauge, BHT=200 F. the natural gas has the following weight composition: Ci=0.85, C2=0.05, N2=0.1.	7

OR

Q.2	A	Find viscosity, molecular weight, specific gravity, pseudocritical properties, Z factor, Bg. Gas data: Pci, Tci are: 668,708,493 psia; 343, 520, 227R. ω_i and μ_i are 0.01,0.09,0.04 and 0.001,0.002,0.0015cp respectively. Explain the chart you use to see to correct for water? Draw the graph of viscosity and Z factor versus pressure.	13
	B	Define and explain the importance of Pseudo critical & Pseudo reduced gas pressure and temperatures?	5

Q. 3	A	Why is gas flow in porous media different from liquid flow?	4
	B	Explain all the constants in the gas flow meter equation	8
	C	Short note on Gas well testing	4

OR

Q. 4	A	Explain the elements of orifice meter. What are the different pressure taps used in a flow measurement. Draw orifice meter diagram	8
	B	A 50-in x 100 lb gauge has a differential pressure range of Rh=50 inches and static pressure range of Rp=100 psi. if square root chart shows a reading of 7.2 for differential pressure and 9.4 for static pressure, calculate differential pressure and static pressure.	4
	C	Write short notes on square root charts	4

Q. 5	A	For a well with a following parameter; D=5790ft, gas gravity is 0.7, Pts=2300Psia, and average temperature of the flow string is 117 F. gas flow rate = 5 MMscfd, Dia = 2inches, 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, static bottom hole pressure and temperature. Tpc=358 R, Ppe=672 psia, f=0.015, z=0.82.	8
	B	Explain tubing pressure transverse with figure?	4
	C	Explain Tubing pressure loss for liquid, gas and multiphase with figure?	4

OR

Q. 6	A	Explain sonic and subsonic flow	4
	B	Write short notes on temperature at choke	4
	C	A 0.6 specific gravity gas flows from a 2-in pipe through a 1-in orifice-type choke. The upstream pressure and temperature are 800 psia and 75 F, respectively. The downstream pressure is 200 psia (measured 2 ft from the orifice). The gas-specific heat ratio is 1.3. a) What is the expected daily flow rate? b) Does heating need to be applied to assure that the frost does not clog the orifice? c) What is the expected pressure at the orifice out? C=0.62, assume NRe is very high, μ=0.01245	8

SECTION I

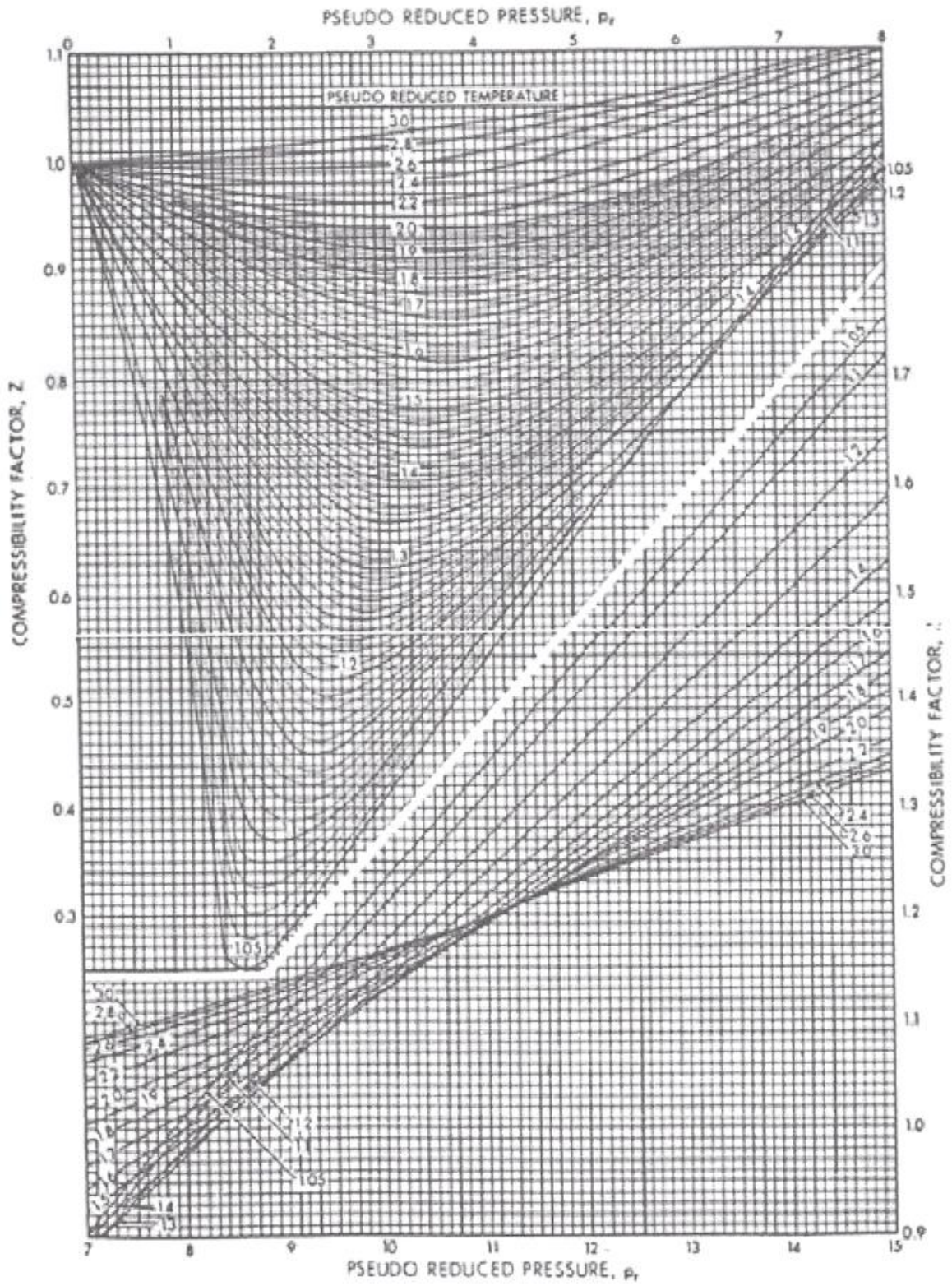| Q. 7	A	What is the criterion for choosing a CO2 removal process? b) Draw a process flow diagram showing the removal of carbon dioxide and explain the process?	8
	B	Write short note on horizontal separator?	4
	C	Write chemical reactions involved in sponge iron process and Alkanolamine process?	4

OR

Q. 8	A	Draw the process for glycol dehydration and explain the design considerations.	6
	B	Explain selection and working of spherical separator with a neat sketch?	6
	C	Explain amine sweetening process with a neat process flow diagram?	4

Q. 9	A	Explain in detail two stage compressor cycle.	4
	B	Draw a diagram a of a centrifugal compressor and name its parts.	4
	C	What is the HP require in compressing 1 MMSCFD from 100 psia and 80 F to 1600 psia using adiabatic equation? The gas is cooled to 80 F between stages. What is the discharge temperature of the gas? k =1.28, gas gravity= 0.6, Z at 400 and 1600 psia are 0.985, 0.94 respectively.	8

OR

Q. 10	A	Find the horsepower required with and without intercooling when compressing 16,000 cfm of natural gas, k = 1.28, measured at 60 F and 14.7 psia from atmospheric pressure of 14.4 to 125 psig. Inlet temperature is 70 F. allow a 4% discharge at each stage.	7
	B	Write a note on reciprocating compressors.	3
	C	Write a note on Compressor selection.	3
	D	Explain the use of Mollier charts in compressor design	3

Q. 11	A	Calculate the gas flow rate in cubic ft / hr through a horizontal pipeline. Data given: D = 12.09, L=1000 miles, e=0.0006 in, T=80 F, Specific gravity of gas = 0.7, Tb = 520 R, Pb = 147 psia, P1 = 600 psia, P2=200 psia, f=0.01223, Z=0.9188, μ=0.0099 cp.	6
	B	Explain effect of liquid loading in gas wells?	3
	C	Explain Turner's method in detail?	3
	D	Write short note on In-line inspection tools	3
	E	Explain inspection and maintenance of natural gas pipeline?	3

OR

Q. 12	A	Write short note on Pipeline efficiency?	3
	B	Write short note on Transmission factor?	3
	C	Give solutions for liquid loading problem?	3
	D	Write note on preventing hydrate formation?	3
	E	Write short note on pipeline cleaning and utility pigs?	3
	F	Write short note on pipeline economics.	3

Compound	Chemical Composition	Symbol (for calculations)	Molecular weight	Critical Pressure (psi)	Critical Temp. (R)
Methane	CH_4	C_1	16.04	673	344
Ethane	C_2H_6	C_2	30.07	709	550
Propane	C_3H_8	V_3	44.09	618	666
iso-Butane	C_4H_{10}	$i-C_4$	58.12	530	733
n-Butane	C_4H_{10}	$n-c_4$	58.12	551	766
iso-Pentane	C_5H_{12}	$i-C_5$	72.15	482	830
n-Pentane	C_5H_{12}	$n-C_5$	72.15	485	847
n-Hexane	C_6H_{14}	$n-C_6$	86.17	434	915
n-Heptane	C_7H_{16}	$n-C_7$	100.2	397	973
n-Octane	C_8H_{18}	$n-C_8$	114.2	361	1024
Nitrogen	N_2	N_2	28.02	492	227
Carbon Dioxide	CO_2	CO_2	44.01	1,072	548
Hydrogen Sulfide	H_2S	H_2S	34.08	1,306	673

PSEUDO REDUCED PRESSURE, p_r

COMPRESSIBILITY FACTOR, Z

PSEUDO REDUCED TEMPERATURE

COMPRESSIBILITY FACTOR,

PSEUDO REDUCED PRESSURE, p_r

(4363)-225
T.E. (Petroleum) Examination - 2013
(2008 Pattern)
Petroleum Production
Operation.

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

Instructions:
          (1) Use of logarithmic tables slide rule, Mollier charts, Electronic packet calculator and steam tables is allowed.
          (2) Answers to the 02 section should be written in separate answer books.
          (3) Figures to the right indicate full marks.
          (4)Neat diagrams must be drawn whenever necessary.
          (5) In section I: Attempt Q1or 2, Q3 or 4, Q5 or 6.
          (6) In section II: Attempt Q7 or 8, Q9 or 10, Q11 or 12.

Section I

Q1. a) Draw the neat schematic sketch of typical well head equipment and indicate all the components and accessories of it.   [10]

    b) What do you mean by Petroleum Production facility in an E& P company? Write the exact sequence of major 'process and storage segment' of it. Write the functions of this segment in brief.   [8]

OR

Q2. a) Draw schematic sketch and explain working of SSSV.   [10]
    b) How the role of surface choke differ from that of SSV and SSSV?   [8]
     Why it is necessary to control the flow rate of a well bore? Explain.

Q3. a) Draw schematic sketch of any one type of landing nipple and mandrel used in a well bore.   [8]
    b) Discuss well activation job and necessary precaution in it.   [8]

OR

Q4. a) Write the various functions and application of production packers. [10]
b) List the reservoir characteristics and production parameters that may be estimated from DST analysis. [6]

Q5. a) Draw schematic of a typical Gilbert chart and explain its application in the selection of production tubing, in brief. [10]
b) Explain heading cycle in brief. [6]

OR

Q6. a) Draw and explain choke performance curves [6]
b) What is critical production rate? Write general and major remedial measures to decrease in well production. [10]

Section II

Q7. a) Discuss the standard procedure of well completion in detail. [10]
b) Draw typical schematic sketch of multiple zone of well completion and write the benefits of it. [8]

Q8. a) Compare between jet and bullet method of well perforation in brief. [8]
b) What is well completion fluid? Discuss the functional requirements and selection criteria for this fluid. [10]

Q9. a) Explain the following in brief: [9]
    i) Standing's extension.
    ii) Flow efficiency
    iii) Solution GOR
   b) For the test of bubble point pressure the following data is reported.
      Calculate: Maximum flow rate and generate Vogel's IPR,
      Oil flow rate at bottom hole pressure flowing pressure=620 psia..Reservoir pressure= 2600 psi. Bubble point pressure=2600 psi. Flowing bottom hole pressure is, 1100 psi at test flow rate=550bbls/day. [7]

OR

Q10. a) Draw and explain typical IPR curves for water drive, gas cap drive and solution gas drive reservoir. [8]

b) Explain steady state and pseudo steady state conditions for a reservoir along with equations, their meaning and assumption of it. [8]

Q11. a) Discuss the step wise procedure for gas and water shut-off job in brief. [8]

b) What is work over job? Classify different workover operations according to formation related problems and mechanical problems well bore. [8]

OR

Q12. a) What is well stimulation? Why it is necessary to carry out this job? Draw general IPR curve and graph of pressure distribution for the well bore in case of a damaged well and successfully stimulated well. [10]

b) What is artificial lift technology? Write different techniques of it. [6]

UNIVERSITY OF PUNE
[4363]-227
T. E. (*Petroleum*) Examination - 2013
Reservoir Engineering-I (2008 Course)
[Time: *3* Hours]　　　　　　　　　　　　　[Max. Marks: 100]

Instructions:

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

SECTION -I

Q.1	A	Define porosity, explain the helium porosimeter.	4
	B	Define saturation, explain any saturation measurement equipment.	4
	C	Define permeability; obtain its units in SI system.	4
	D	Explain the concept of wettability with examples.	4
Q.2		Define and explain Bo, Bw, Bg, cw, co, cg versus pressure and their units and approximate range.	16
Q. 3	A	What is flash and differential Liberation Process.	4
	B	Derive the equation for radial laminar flow of gas in porous media.	8
	C	A gas reservoir drains 130 acres and is partially pressured by a water aquifer. The reservoir permeability is 10 md, porosity is 12% average pressure is 3500 psia. Temperature is 140F and formation thickness is 127 ft. Gas viscosity is 0.012 cp, z=0.9. If the well is flowing at	4

3150 psia and rw=0.4 ft, calculate

i) Flow rate, ii) BHP if rate is increased to 9.5MMSCF/D

Q. 4   A   Explain relative permeability   18
        B   Explain drainage and imbitions capillary pressure curve.
        C   Explain how an EOS is used in Petroleum Engineering.

SECTION II

Q. 5   Explain, compare and contrast drive mechanisms and   16
             drive indices for different reservoirs by showing various
             graphs. Give mathematical derivation for drive indices.
             Do drive indices change for a reservoir? Explain

Q. 6   A   What is volumetric reservoir? Derive an equation to find   6
             Initial Oil in place (IOIP) for a volumetric, undersaturated
             oil taking into account oil water and formation
             compressibility.
        B   The following data is given for an oil field no initial gas
             cap and no water drive. Oil pore volume of the
             reservoir=75MM cu ft, Solubility of gas in crude =0.42
             SCF/STB/psi, Initial bottom-hole pressure=3500psia,
             BHT=140 F, Saturation pressure=2400 psia, FVF at
             3500=1.333 bbl/STB, Compressibility factor of the gas at
             1500 psia =0.95, Oil produced when pressure is 1500
             psia=1.0 MMSTB, Net cumulative produced GOR=2800
             SCF/STB.
             Calculate i) initial STB of oil in the reservoit   3
                         ii) initial SCF of gas in the reservoir   2
                        iii) initial dissolved GOR of the reservoir   2
                         iv) SCF of gas remaining in the reservoir at   3
                             1500 psia.
                          v) SCF of free gas in the reservoir at 1500 psia 2

Q. 7   Derive the generalized material balance equation. Explain   16
             the meaning and usefulness of F=NEo+We.

Q. 8   The initial volume of gas in place in a certain reservoir is   16
calculate from electric log and core data to be 200 MMM
SCF(14.7 and 60F) underlying 2250 productive acres, at
an initial pressure of 3500 psia and 140F. The pressure
production history is

Pressure	Production MMMSCF	Gas deviation factor at 140F
3500(initial)	0.0	0.85
2500	75.0	0.82

i) What is the initial volume of gas in place as calculated
   from the pressure production history assuming no water
   influx.
ii) Assuming uniform sand thickness, porosity, and
    connate water, if the volume of gas in place from
    pressure-production data is believed to be correct, how
    many acres of extension is the reservoir.
iii) If, the gas in place is calculated from log and core data
     is correct, how much water influx must have occurred
     during the 75 MMMSCF of production to make the
     two figures agree.

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

Instructions :
(1)Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from Section I and Q7 or Q8 , Q9 or Q10,
Q11 or Q12 from section II
(2)Answers to the **two sections** *should be written in* **separate answer-books.**
(3)Black figures to the right indicate full marks.
(4)Neat diagrams must be drawn wherever necessary.
(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) If f(z)= u+iv is an analytic function ,find f(z)   [6]

if $u+v = e^{-x}$ [cos y – sin y].

b) Evaluate $\int \dfrac{\sin \pi z^2+2z}{(z-1)^2(z-2)}$ dz , where 'c'is the circle $|z|$=4   [6]

c) Find the bilinear transformation, which sends the points l, i,-l from   [5]

z-plane into the points i, o, -i of w plane.

OR

2 .a) If the imaginary part of an analytic function f (z) is $r^n \sin (n\theta)$ [5]

find f (z).

b) Evaluate $\int_0^{2\pi} \dfrac{d\theta}{(5-3 \cos \theta)}$ [6]

c) Show that $w = \dfrac{z-i}{1-iz}$ maps upper half of z –plane onto interior of the   [6]

unit circle in W plane.

3.a) Calculate the central moments and β_1 and β_2 for the following [9]
distribution.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
no. of students	1	6	10	15	11	7

3.b) The following regression equations and variance are obtained from [8]
 a correlation data , x on and y on x resp. $20x - 9y - 107=0$, $4x-5y+33=0$
Variance of $x = 9$. Find
(i) mean value of x and y,
(ii) correlation coefficient and standard deviation of y

<p style="text-align:center">OR</p>

4.a) Find the correlation coefficient and obtain the equation to the   lines [9]
of regression for the data

x	6	2	10	4	8
y	9	11	5	8	7

b) The mean and standard deviation of 25 items is found to be [8]
11 and 3 respectively. It was observed that one item 9 was incorrect
 calculate the mean and standard deviation if
i)The wrong item is omitted
i) it is replaced by 13

Q 5.a] Three groups of children contain respectively 3 girls and 1 boy ;   [5]
2 girls and 2 boys; 1 girl and 3 boy. One child is selected at random from each group
Find the chance of selecting 1 girl and 2 boys.

b) The overall percentage of failures in a certain examination is 20.   [6]
If six candidates appear in the examination , what is the probability that at least five
pass the examination.

c) Find the probability that at most 5 defective items will be found in a   [5]
box of 200 fuses if experience shows that 2 percent of such fuses are defective.

OR

Q 6. a) If the probability that an individual suffers a bad reaction from a   [5]
certain injection is 0.001, determine the probability that out of 2000 individuals
a)exactly 3, b)more than 2 individuals will suffer a bad reaction [use poisson]

b) The mean yield per plot of a crop is 17 kg and standard deviation is 3kg   [6]
. It distribution of yield per plot is normal , find the percentage of plots giving yields:
1)Between 15.5 kg and 20kg   when z_1 =0.5 Area =0.1915
2)More than 20kg   when z_2 =1 Area = 0.3413

c) The mean and Variance of Binomial distribution are 6 and 2 respectively   [5]
Find p (r≥ 1).

SECTION II

Q7.a) Establish the following results   [9]

i)$E=(\dfrac{\delta}{2}\sqrt{1+\dfrac{\delta^2}{4}})^2$

ii) $\frac{1}{\nabla} y_n - \frac{1}{\nabla} y_0 = y_0+y_1+y_2+\ldots\ldots\ldots y_n$

iii) $1+ \delta^2 \mu^2 = (1+\frac{1}{2} \delta^2)^2$

b) Evaluate $\int_0^3 \frac{dx}{1+x}$, by dividing the interval in six parts. Use   [8]

Simpson's $\frac{3}{8}$ th rule calculate log 2 Estimate the bound of truncation error in the process

OR

Q8.a) For the following tabulated data   [8]

x	50	51	52	53	54
f(x)	39.1961	39.7981	40.3942	40.9843	41.5687

obtain f (50.5) and f (53.4) using forward and backward difference interpolation formula respectively.

b) Evalute $\int_0^{0.8}$ [$\log_e$ (x+1) + sin2x] dx , taking h=0.1 and   [9]

using simpson's $\frac{1}{3}$ rule. Write algorithm for the method used.

Q9 a) Solve the system of equations by using Gauss seidel method.   [8]

   10x-2y+3z=15

   2x+30y+5z=77

   x-3y+20z=55

b) Find the real root of the equation $x^3+2x-5=0$ by   [8]

applying Newton-Raphson method at the end of fourth iteration.

write the algorithm for the method used.

OR

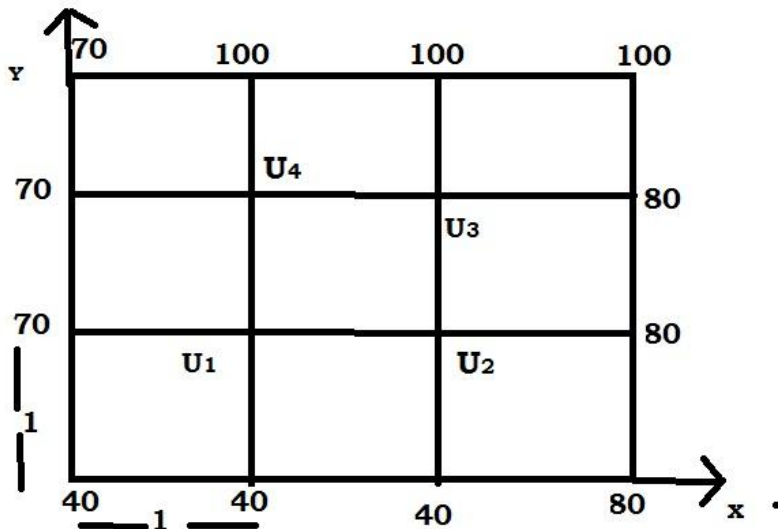Q10.a) Fit a parabola of the form $y=ax^2+bx+c$ to the following data   [8]

using method of least squares

x	0	1	2	3	4	5	6
y	5	8	15	26	41	60	83

b) Solve the equation $\dfrac{dy}{dx} = \sqrt{x + y}$ (x=0, y=1, h=0.2) [8]

to find y at x=0.4 using Runge –kutta method of 4th order

Q.11 a) Solve the equation $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ to find the

unknown pivotal values, corresponding to the grid shown

below h=k=1

b) Solve the following linear programming problem by using simplex [9]

method

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

subject to: $x_1 + 2x_2 + x_3 \le 430$

$\qquad 3x_1 + 2x_3 \qquad \le 460$

$\qquad x_1 + 4x_2 \qquad \le 420$

$\qquad x_{1,} x_{2,} x_3 \ge 0$

Q12.a) Solve the equation $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$, using explicit finite difference [9]

scheme, with conditions $u(0,t) = 0$, $u(1,t) = 0$ for all t

$u(x,0) = \sin \pi x$, $0 \le x \le 1$

take $\partial x = 0.1$, $\partial t = 0.001$ and find $u(x,t)$ at all nodal points at

t= 0.001, 0.002, 0.003

b) Using simplex method solve the following LPP [8]

   Maximize $z = 3x_1 + 2x_2$

   subject to: $x_1 + x_2 \le 4$

   $x_1 - x_2 \le 2$

   $x_1,\ x_2, \ge 0$

UNIVERSITY OF PUNE
[4363]-222
T. E.(Petroleum Engineering)Examination - 2013
PETROLEUM GEOLOGY-I
(2008 Pattern)

[Total No. of Questions:11] [Total No. of Printed Pages :3]

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

Instructions :

 (1) Attempt any three questions from Section I and Section II
 *(2) Answers to the **two sections** should be written in **separate answer-books**.*
 (3) Black figures to the right indicate full marks.
 (4) Neat diagrams must be drawn wherever necessary.

SECTION-I

Q1 Define the following any five [20]

 a) Clay minerals

 b) Sphericity and roundness

 c) Bedform generations

 d) Hjulstrom Diagram

 e) Polymict and oligomict conglomerate

 f) Hydrolysis

 g) Divergent plate boundary

 h) Parts of fold

 i) Horst and Graben

Q2 a) Draw a flowchart to explain formation of sedimentary rocks [10]

b) Explain with the help of neat sketch, relationship between rate of [5]

solubility of calcite and quartz with pH of water

OR

Q3 a) How mass movement is classified based on moisture content, grain size variation and velocity? [8]

b) How to interpret internal structure of the earth based on study of earthquake waves? [7]

Q4 a) What are normal and reverse and strike slip faults? What is a criterion to recognize faults in the absence of any visible displacement? [8]

b) A limestone bed is recorded in boreholes X and Z at a depth of 300 m and 650 m respectively. Its presence in borehole Y is insignificant or minor. The boreholes are taken along E –W direction with spacing of 500 m. A fault dipping 45° towards west is interpreted at a depth of 600 m in borehole Y. The limestone dips at an angle of 5° towards east and it has a vertical thickness of 150 m. Classify the fault. What is the heave, throw, and net slip of the fault? At what depths fault would be interpreted in boreholes X and Z? [7]

OR

Q5 a) Answer in brief with suitable diagrams [15]
    1. Types of fold based on interlimb angle
    2. Mohr composite failure envelope

SECTION-II

Q6 a) Draw a cross-sectional view of a sedimentary basin to show the relationship between facies and environment [6]

b) Discuss the classification sedimentary rocks based on the triangular diagram of lime-sand-clay/mud. [9]

OR

Q7 a) Discuss the Dunham's Scheme of classification of carbonate rocks. [9]

b) What are the digenetic changes taking place in sedimentary rocks with increasing depth and temperature? [6]

Q8 a) Discuss various statistical ways to study the sedimentary rocks [10]

b) How is cyclicity recognized in sedimentary sequence? [5]

OR

Q9 Answer any three of the following [15]
   a) Mode of preservation of fossils
    b) Use of microfossil in the exploration of hydrocarbons
    c) Dolomitization and dedolomitization
    d) Use of trace fossils to study various sedimentary environments

2

Q10 a) Write Geological Time Scale in a tabular form with important event [10] in each era.

b) Following is a sedimentary sequence encountered in a well. A break in [10] Sedimentation exists between two successive units. Reconstruct the chronology of events based on emergence and submergence of coast. Justify your answers.
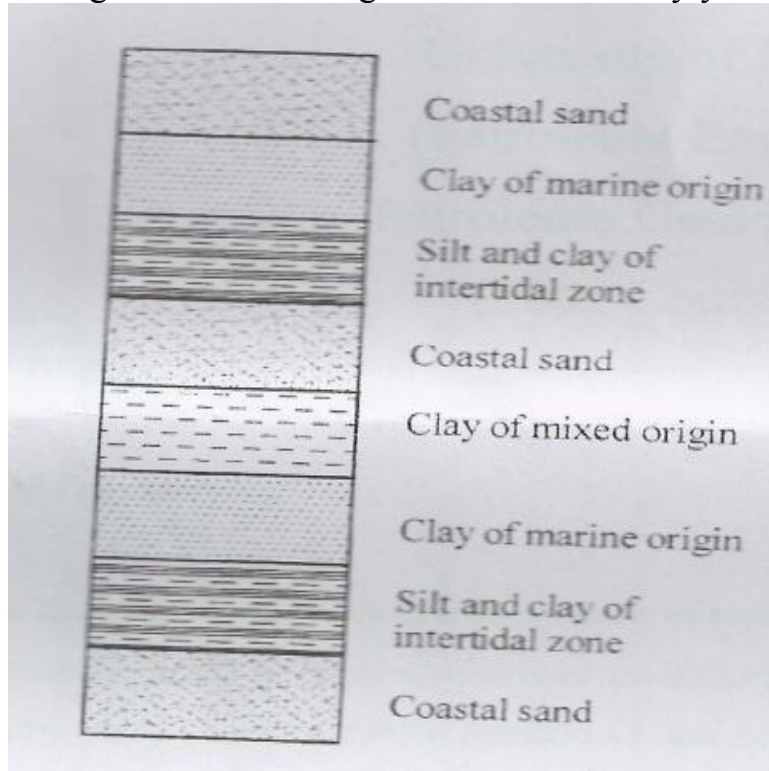
OR

Q11 a) Give Chronology of events in a tabular format for the following [10] interpreted subsurface section
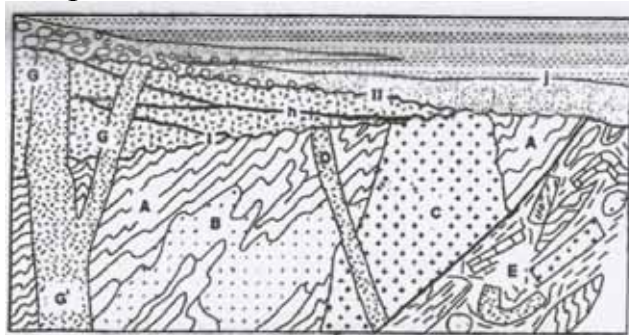
b) What is transgression and regression? Explain the concept with the help [10] of suitable diagram.

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

    *(1) Question nos. **1** and **8** are compulsory. Out of the remaining attempt 2 questions from section I and section II.*
    *(2) Answers to the **two sections** should be written in **separate answer-books**.*
    (3) Black figures to the right indicate full marks.
    (4) Neat diagrams must be drawn wherever necessary.
    (5) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.
    (6) Assume suitable data, if necessary.

SECTION-I

Q1 a) With the help of proper figures, describe basic components of a drill string used to drill a well [6]

b) Discuss the horse power calculations for draw-works & rotary. [6]

c) Discuss advantage and disadvantage of top drive system [6]

Q2 a) What are the basic design features of rotary roller bits? Explain the tooth wear grading system of these bits? [6]

b) 171/2" hole size, 2000M deep well consist of drill string assembly [10]
 as twelve 8" Drill collar, six 6.5" Drill collar and thirteen 5" HWDP capacity:
8" Drill collar-0.0252 BBLS/meter
6.5" Drill collar-0.0252 BBLS/meter
5" HWDP = 0.0287 BBLS/meter
5" Drill pipe = 0.0252 BBLS/meter
Discharge of pump is 0.123 bbls/stroke at 100% efficiency. Length of each 8" and 6.5" drill collar is=9.40 M. Length of HWDP=9.27 M. calculate number of strokes for one cycle if pump efficiency is 97% ,well contains 20" casing upto 1200 M

Capacity: annulus:

5" D/P x 20" casing = 1.0854 BBLS/M

17.5" OH x 8" Drill collar= 0.7721 BBLS/M

17.5 OH x 6.5" Drill collar= 0.8414 BBLS/M

17.5 OH x 5" Drill pipe= 0.8964 BBLS/M

Q3 a) with the help of neat and labeled figure describe any two fishing tools [8]
to recover tubular object.

b) Draw typical BOP stack and discuss different ram preventers. [8]

Q4 Write short notes on [16]

i) Mechanical stuck up

ii) types of losses and remedial methods

iii) Drill of test

iv) Triplex single acting mud pump

SECTION II

Q5 a) Calculate no of sacks, water required for lead and tail slurry for 13 3/8" [8]
casing cementation job. If TOC is 600 m from bottom

Height of tail slurry=400m

yield of lead slurry= 1.66 cuft/sack

water requirement 8.77 gal/sack

tail slurry yield 1.15 cuft/sack

water requirement 5 gal/sack

(take 20% extra for open hole)

25 M shoe track

b) Discuss functions, types, API grades of casing in detail [8]

Q6 a) Discuss functions of drilling fluid. [6]

b) Rheological properties of drilling fluid. [6]

c) Calculate hydrostatic head of a mud column if depth is 10,000 ft and mud [2]
weight is 1.4 gm/cc

d) Find out Mud gredient of 12 ppg [2]

Q7 a) Draw circulation system on a drilling rig and explain pressure losses in[8]
a system
b) Discuss effect of ECD on BHP [4]
c) Discuss change in pressures during drilling operations, Tripping and casing[4]
operations.

Q8 Write short notes on [18]
i. consistency of a cement
ii. Fann viscometer
iii. MBT (Methelene blue test)
iv. Squeeze Cementation

[Total No. of Questions:12]   [Total No. of Printed Pages :3]
[Time : 3 Hours]   [Max. Marks : 100]

Instructions :

*(1) Answer **three questions** from each section.*
*(2) Answers to the **two sections** should be written in*
*   **separate answer-books**.*
(3) Black figures to the right indicate full marks.
(4) Use of logarithmic tables, slide rule, Mollier charts,
*   electronics pocket calculator is allowed.*
(5) Assume suitable data, if necessary.

SECTION-I

Q1   a) Write a note on the Joule Thomson Expansion.   [8]

    b) Distinguish between state function and path function.   [6]

    c) A mercury manometer used to measure pressure inside a vessel   [4]
indicates 400 mm. One end of the manometer is exposed to the atmosphere.
The atmospheric pressure is 1.01325 bar. Density of mercury is 13.56×10^3
Kg/m^3 and g=9.81 m/s^2 . what is the absolute pressure in the vessel in N/m^2 ?

OR

Q2   a) Explain the Joule's experiments that helped in establishing the first   [6]
Law of thermodynamics.

    b) Write the expressions for the entropy change in the following   [4]
processes involving ideal gases: i) Constant pressure process ii) Isothermal
process

    c) Water is flowing in a straight insulated pipe of 25mm i.d. there is no   [8]
device present for adding or removing energy as work. The upstream
velocity is 10m/s. the water flows in a section where the diameter is
suddenly increased.

i) What is the change in enthalpy if the downstream diameter is 50mm?

ii) What is the maximum enthalpy change for a sudden enlargement in the pipe?

Q3   a) Explain the phenomena of retrograde condensation and vaporization. [8]

b) Explain the Redlich Kwong equation, calculate the pressure of 0.5 kg [8] of gaseous ammonia contained in a vessel of 0.03 m³ at a constant temperature of 338K. the critical temperature and pressure are 405.5K and 112.8 bar.

OR

Q4   a) State the principle of corresponding states and hence explain the use [8] of compressibility charts

b) Calculate the volume occupied by one mole of oxygen at 300 K and [8] 100 bar using i) The ideal gas law ii) The van der Waals equation. Take $a=0.1378$ Nm^4/mol^2 and $b=3.18 \times 10^{-5}$ m³/mol

Q5   a) Discuss the different methods used to determine fugacity [8]

b) What are Maxwell's relations? Discuss their significance. [8]

OR

Q6   a) Define Helmholtz and Gibbs free energy. Give the significance of [8] each of them.

b) At 200 K, the compressibility factor of oxygen varies with pressure [8] as given below. Evaluate the fugacity of oxygen at this temperature and 100 bar

P, bar	1	4	7	10	40	70	100
Z	0.997	0.988	0.978	0.969	0.873	0.776	0.687

SECTION-II

Q7   a) Mixtures of n-Heptane (A) and n-Octane (B) are expected to behave [10] ideally. The total pressure over the system is 101.3 kPa. Using the vapour pressure data given below, i) Construct the boiling point diagram ii) The equilibrium diagram

T,K	371.4	378	383	388	393	398.6
P_A,kPa	101.3	125.3	140	160	179.9	205.3
P_B,kPa	44.4	55.6	64.	74.8	86.6	101.3

b) Explain the concepts of dew point, bubble point and vaporization [8] equilibrium constant. Give the expressions for the same.

Q8   a) For a system of n-pentane (1) and n-heptane (2), the vapour pressures [10]
are given by the Antoine equation: $\ln P = A - \dfrac{B}{T-C}$

where P is in kPa and T is in K. the constants are as follows

System	A	B	C
n-pentane	13.8183	2477.07	40
n-heptane	13.8587	2911.32	56.56

Assuming that the solution formed is ideal, calculate the total pressure
and the vapour composition in equilibrium with a liquid of composition
$x_1 = 0.44$ at T=333.2K.

b) For each of the following non reactive systems, determine the   [8]
available degrees of freedom.

i) Two miscible materials in vapour-liquid equilibrium with vapour
composition specified at a given temperature and pressure.

ii) A mixture of methane and air in contact with a solid adsorbent at
atmosphere pressure and a specified temperature.

iii) Liquid in equilibrium with a mixture of water vapour and nitrogen.

iv) Two partially miscible liquid phases and a vapour phase in
equilibrium with them at a constant pressure.

Q9   a) Explain the Kelvin's equation for lowering the vapour pressure.   [8]
State its limitations.

b) Explain in brief: i) Imbibition ii) Drainage iii) Wettability   [8]
iv) Connate water saturation

OR

Q10   a) Derive the Young-Laplace equation.   [8]
b) Write a note on the Knudsen Diffusivity.   [8]

Q11   a) With the help of a neat diagram, explain the various regions in the   [8]
solid liquid equilibrium diagram.

b) Explain the significance of gas hydrates in the field flow assurance.   [8]

OR

Q12   a) What are resins? How do they affect the stability of asphaltenes?   [8]
b) Explain the concept of wax precipitation with any one of the   [8]
thermodynamic models.

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T. E. (*Petroleum Engineering*) Examination - 2013
(*Petroleum Geology-II*)(*2003 & 2008 Course*)

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

Instructions:

    1   *All questions are compulsory.*

    2   *Answers to the **two sections** should be written in **separate answer-books**.*

    3   *Neat diagrams must be drawn wherever necessary.*

SECTION -I

Q.1   What is the importance of study of oilfield produced water?   15
Explain one chemical and one genetic classification of oil field water.

OR

Q.2   Explain important physical and chemical properties of crude oil   15

Q.3   A   Under what conditions organic matter is accumulated in a   8
sedimentary basin?

     B   Explain the properties that a rock should possess to qualify as a   7
reservoir rock?

OR

Q.4   What is meant by Petroleum System? Explain in brief Source   15
Rock Evaluation.

Q.5   Write in brief on **any four** of the following.   20
       a. Structural Traps
       b. Trapping mechanism in sand shale sequence
       c. Unconventional natural hydrocarbon sources
       d. Primary Migration
       e. Geochemical Fossils
       f. Origin of Hydrocarbons
       g. Diagenetic changes in organic matter
       h. Carbon Preference Index

SECTION II

Q.6   Describe a generalized model of a typical depositional basin.   15
What is meant by lateral and vertical variation?

Q.7   Explain in brief sedimentary basin classification proposed by   15
        Klemme

Q.8   Write in brief on **any three** of the following   15
        a. Spatio-Temporal Distribution of Hydrocarbons
        b. Maturation of hydrocarbons in reservoir rocks,
        c. Classification of Petroliferous Basins of India
        d. Heat flow in sedimentary basins
        e. Geological factors giving rise to abnormal pressures
                                OR

Q.9   Describe geology and hydrocarbon potential of **any one** of the   15
        hydrocarbon producing basins of India.
        a. Mumbai offshore basin
        b. Cambay basin
        c. Krishna Godavari basin

Q.10   Answer **any four** of following: 20
        a. What are structure contour maps and their significance?
        b. Give importance of Geo-Technical Order (Well Plan) and
            give its contents in general.
        c. Geological heterogeneity
        d. Shale Gas resources in India
        e. Draw generally accepted symbols to show different types
            of sedimentary rocks and types of wells.
        f. How is gas analysis carried out at the drill site? Which
            gases are generally looked for?
        g. Origin and Occurrence of Coal Bed Methane
        h. Gas Hydrates

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T. E. (Petroleum) Examination - 2013

PETROLEUM PRODUCTION ENGINEERING-I (2008 Course)

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

Instructions:

1 *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from Section I and Q7 or Q8, Q9 or Q10, Q11 or Q12 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 *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

Q.1   A   Write usability of SRP, ESP, continuous gas lift and   18
Intermittent gas lift in terms of excellent/good/fair/poor
in a tabular form, for following well parameters. PI,
GOR, adaptability to deviated wells, capability to
produce sand, high volume lift capability, ability to
handle viscous oil and depth limits

OR

Q.2   A   Write usability of PCP, Hydraulic jet pump, Hydraulic   18
reciprocating and Plunger lift in terms of
excellent/good/fair/poor in a tabular form for following
well parameters. PI, GOR, adaptability to deviated
wells, capability to produce sand, high volume lift
capability, ability to handle viscous oil and depth

limits.

Q. 3   A   Find the point of gas injection. Perforation depth is   10
             7,000 ft, where formation pressure is 2500 psi, the
             wells PI is 2.5 bbl/day/psi. The produces 600 bb/day of
             oil with a formation GLR of 100 SCF/STB having
             gradient of 400 psi/1000 ft, through a tubing with 2
             3/8 inch. OD and a WHP of 200 psi. Lift gas of 0.75
             relative gravity is injected with a surface injection
             pressure of 800 psi. Static gas gradient for the given
             gas is 26 psi / 1000 ft. If the injection GLR for the
             gradient you have calculated is 250 SCF/STB,
             calculated the daily gas injection rate.

        B   Explain 'liquid holdup' or 'liquid fall back' in brief   6

                            OR

Q. 4   A   Which gas lift method you will recommend for low   8
             bottom hole pressure? Draw neat schematic sketch of it
             to show multi point injection.

        B   Draw any one type of gas lift installation and write its   8
             advantages

Q. 5   A   Following data is given, calculate peak and minimum   8
             polished rod loads, counterbalance required and peak
             torque   for   conventional   SRP   unit
             Given data: Pumping depth= 7000ft, desired fluid
             production = 200 bpd, stroke length = 64 in, volumetric
             efficiency = 82%, pumping speed = 18 spm, pump
             diameter = 1 $\frac{1}{4}$ in, rod number = API No. 76

             (1.814lb/ft), fluid specific gravity= 0.96

        B   Derive an equation to calculate ideal counterbalance   8
             effect in SRP system

                            OR

Q. 6   A   Calculate the total nameplate motor horsepower for the   10
             prime mover of SRP. Given data and information:

$1\frac{3}{4}$-in. plunger is to be set with 3600 ft of $\frac{5}{8}$-in. sucker rods. Pumping speed of 16 spm and a polished rod stroke length of 42 in is to be used. Desired production is 160 bbl per day. Working fluid level is about 2100 ft, and that the specific gravity of the produced fluid is 0.83. Assume 70% efficiency of surface pumping system and cyclic loading factor of 1.5

B   Draw typical dynagraph curves to indicate following   6
subsurface conditions in it

     i)   Plunger under travel and over travel
     ii)   Gas pound
     iii) Vibrations

SECTION II

Q. 7   A   List various components of surface and subsurface part   18
of electrical submersible pumping system and write the
function of each in brief

OR

Q. 8   A   Draw neat schematic sketch of surface and subsurface   9
details for an ESP.

B   Select a suitable electrical submersible pump and   9
necessary parameters for Following given data:

Casing size= $8\frac{5}{8}$ ", O.D.

Tubing size = $5\frac{1}{2}$"O.D.(New)

Depth = 3900 ft   Perforations = 3700-3900 ft

Power source= 12,500V primarily Temperature =120°F

Static fluid level = 1100 ft from S/C Water S.G. = 1.1

Desired rate = 9,00 b/d

Friction loss in horizontal line = 55 ft/1000 ft

Tubing friction loss = 20 ft/1000 ft

One stage develops 55 ft of head and 6.1 hp/ stage

Surface flow line = 2000 ft of 4 inch line with elevation = 40 ft

Production test shows that the well is making 7000 bbls/day

With the liquid level at 1800 in the casing.

Q. 9	A	Draw the neat schematic of following graphs and explain their role in production optimization in brief	12

    i)   Choke performance curves
    ii)   Production rate Vs Tubing diameter
    iii)   Pressure drop inside a production tubing Vs Production rate at optimum GLR point and for various values of GLR

	B	Write the reason for gas slippage	4

OR

Q. 10	A	What is nodal analysis? Explain, how it can be useful to determine pressure drop and flow capacity for a gravel pack and perforation job. Assume that perforation diameter and all the other reservoir parameters are constant and draw typical graph of pressure loss Vs flow rate. Show effect of number of perforations on production rate. Select any two tubing out of available as per API say, 1.995/2.441/3.5 inch and indicate operating point.	16

Q. 11	A	Draw and explain in brief surface read out of pressure variation during hydraulic fracturing job on a pressure Vs time plot	10
	B	Write and explain any three parameters to determine productivity of fractured wells	6

OR

Q. 12	A	Explain the acidizing techniques for carbonate	8

formations.

B   Draw a typical DST curve showing low productivity 8
and high formation damage problem of a well. Also
write the general range of skin factor value for a
damaged and highly stimulated well

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T. E. (PETROLEUM ENGINEERING) Examination - 2013
**PETROLEUM EQUIPMENT DESIGN AND DRAWING**
(2008 Course)

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

Instructions:

   1 *Q.1&Q .5 are compulsory*

   2 *Solve any two from Q.2 to Q.4 & any two from Q.6 to Q. 8*

SECTION -I

Q.1   A)   Explain use of standards and codes in design activity And give API   [10]
           codes for following (At least 2 for each)
           i)   Sucker Rod Pump
           ii)   Casing Pipes
           iii)   Well head

      B)   Design a muff coupling which is used to connect two steel shafts   [10]
           transmitting 60 kW at 398 rpm. The material for shafts and key is
           plain carbon steel for which allowable shear and crushing stresses
           may be taken as 42 MPa and85 MPa respectively. The material for
           muff is CI. for which the allowable shear stress may be assumed as
           18 MPa.

Q.2   A)   A single block brake with a torque capacity of 15 N.m (refer fig. 1).   [12]
           The coefficient of friction is 0.3 and maximum pressure on the brake
           lining is 1 N/mm^2 . The width of the block is equal to its length.
           Calculate
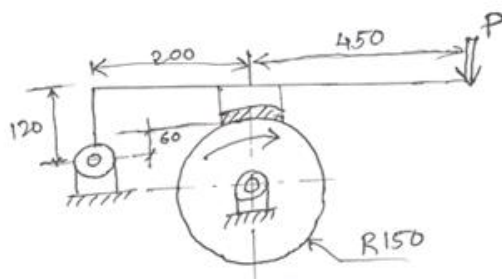
           i)   The actuating force

ii)   The dimensions of the block
iii)   The resultant hinge pin reaction
iv)   The rate of heat generated, if the brake drum rotates at 50 rpm.

B) What is Galling in chains?   [3]

Q. 3   A) Explain polygonal effect in chains and hence relation of variation in   [8]
            velocity and no. of teeth
       B) Derive the equation for optimum velocity of belt for maximum   [5]
            power transmission.
       C) Give advantages of v - belt over flat belt   [2]

Q. 4   A) A double acting reciprocating pump, running at 70 rpm, is   [6]
            discharging 1.75 m^3 of water per minute. The pump has stroke of
            600mm. The diameter of piston is 200 mm. The delivery and suction
            heads are 30 m and 8m respectively. Find the slip of the pump and
            power required to drive the pump.
       B) Explain : -   [4]
            i)   Slip of reciprocating pump
            ii)   Negative slip of reciprocating pump
       C) Explain different terms used in compression springs using suitable   [5]
            sketches.

SECTION II

Q. 5   A) Explain design of following types of pressure vessel heads for   [10]
            internal pressure conditions.
            i)   Conical
            ii)   Torispherical
            iii)   Elliptical
            iv)   Hemispherical
       B) A pressure vessel having outer diameter 2.6 m and height 6.5 m is   [10]
            subjected to an internal pressure of 17kg/ cm^2. If the vessel is
            fabricated as class C vessel, with welded joint efficiency is 70% and
            50% ; If the vessel is fabricated as class B vessel, joint efficiency is
            85% ; If the vessel is provided with a strip all along the longitudinal
            joint, joint efficiency is 100% .Calculate the vessel thickness under
            these different conditions. And find out how much is the percentage
            material saving by welding a strip along the longitudinal joint.
            Allowable stress of material = 1020kg/ cm^2 Corrosion Allowance is
            1 mm.

Q. 6   A) What are different types of agitators? Explain with suitable sketches.   [8]

B) Explain Design of Shell and bottom of storage tank using code IS 803. [7]

Q. 7 A) Design a sea water cooler to cool the total Stream from a field in its later stages of life from a following temperature of 180° f to 100° f to allow further treating. [15]

inlet : - 100 mmscfd at 0.68SG,
       6000 bopd at 0.78 SG
       16 bbl water /mm scf
       $T_1 = 180^{\circ}F$, $P_1 = 1000$ psig,
       Water vapour in gas = 62 lb/mmscf.

Outlet :- $T_1 = 100^{\circ}$ f $P_1 = 990$ psig,
       Water vapour in gas = 28 lb / mmscf,
       Seawater $T_3 = 80^{\circ}F$
       Limit temp. rise to = $12^{\circ}F$

use 1''OD 10 BWG tubes on $1\frac{1}{4}$ inch pitch

Given :- Gas specific heat = 0.528 Btu/lb $^{\circ}F$
       correction factor (Δ CP) = 1.6
       condesate sp. heat = 0.535 Btu/lb $^{\circ}F$
       latent heat l = - 997 Btu/lb
       correction factor of tubes = F = 0.95
       Tube length = 45 ft
       Tube external surface area = A= 0.262 ft^2/ft
       U = 90 Btu/hr – ft^2 – $^{\circ}$f

Calculate :-
  i) Water flow rate in outlet and water vapour condensed
  ii) Heat duty
  iii) Sea water circulation plate.
  iv) Pick a type of Heat exchanger & no. of tubes required.

Q. 8 A) Explain design considerations of subsea storage tank. [8]
    B) What are different vessel internals used in Three phase separators. [4]
    C) Explain design of Agitator shaft based on critical speed. [3]