

[Total No. of Questions: 6]

[Total No. of Printed Pages: 4]

**UNIVERSITY OF PUNE**

**[4364]-234**

**B. E. (Petroleum Engineering) Examination - 2013**

***Natural Gas Engineering***

***(2003 Course)***

**[Time: 3 Hours]**

**[Max. Marks: 100]**

***Instructions:***

- 1 *Answers to the two sections should be written in separate answer-books.*
- 2 *Figures to the right indicate full marks.*
- 3 *Neat diagrams must be drawn wherever necessary.*
- 4 *Use a non programmable calculator*
- 5 *Assume suitable data, if necessary and clearly state it.*

**SECTION -I**

- |      |   |   |   |
|------|---|---|---|
| Q.1  | A | Draw the graph of viscosity, $B_g$ , $C_g$ and Z factors versus pressure and explain?   | 6 |
|      | B | Explain the chart you use to correct gas properties for N <sub>2</sub> 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: $C_1=0.85, C_2=0.05, N_2=0.1$ . | 7 |
| Q.2  | 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 |
| Q. 3 | A | For a well with a following parameter; $D=5790$ ft, gas gravity is 0.7, $P_{ts}=2300$ Psia, and average temperature of the flow string is 117 F. Gas flow rate-5MMscfd,   | 8 |

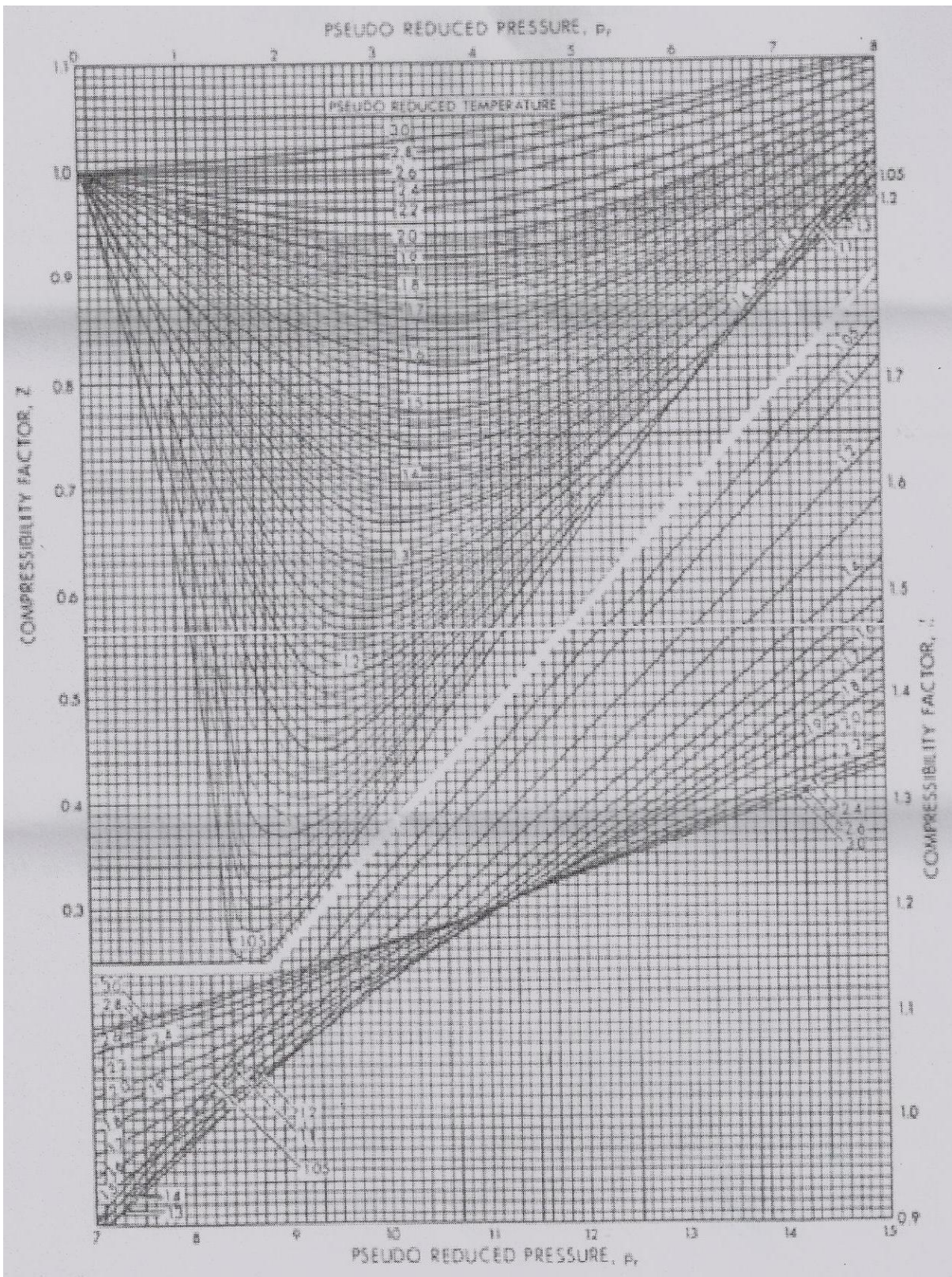
Dia=2inches Twf=160 F, Ttf=83 F Ptf=2122 psia, length of tubing 5700 ft, well is vertical. State your assumed values clearly and only do one iteration to find the flowing bottom hole pressure, static bottom hole pressure and temperature. Tpc=358 R, Ppe=672 psia, f=0.015, z=0.82

- B Explain tubing pressure transverse with figure? 4
- C Explain tubing pressure loss for liquid, gas and multiphase with figure? 4

## SECTION II

- Q. 4
  - A Draw the process diagram 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? 6
  
- Q. 5
  - A Explain in detail two stage compressor cycle. 4
  - B Draw a diagram of a centrifugal compressor and name its parts. 4
  - C What is the HP required in compressing 1 MMSCFD from 100 psia and 80 F to 1600 psia using adiabatic equation? The gas is cooled to 80 F between stage. 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
  
- Q. 6
  - 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 <sub>4</sub>	C <sub>1</sub>	16.04	673	344
Ethane	C <sub>2</sub> H <sub>6</sub>	C <sub>2</sub>	30.07	709	550
Propane	C <sub>3</sub> H <sub>8</sub>	C <sub>3</sub>	44.09	618	666
iso-Butane	C <sub>4</sub> H <sub>10</sub>	i-C <sub>4</sub>	58.12	530	733
n- Butane	C <sub>4</sub> H <sub>10</sub>	n-C <sub>4</sub>	58.12	551	766
iso-Pentane	C <sub>5</sub> H <sub>12</sub>	i-C <sub>5</sub>	72.15	482	830
n-Pentane	C <sub>5</sub> H <sub>12</sub>	n-C <sub>5</sub>	72.15	485	847
n-Hexane	C <sub>6</sub> H <sub>14</sub>	n-C <sub>6</sub>	86.17	434	915
n-Heptane	C <sub>7</sub> H <sub>16</sub>	n-C <sub>7</sub>	100.2	397	973
n-Octane	C <sub>8</sub> H <sub>18</sub>	n-C <sub>8</sub>	114.2	361	1024
Nitrogen	N <sub>2</sub>	N <sub>2</sub>	28.02	492	227
Carbon Dioxide	CO <sub>2</sub>	CO <sub>2</sub>	44.01	1,072	548
Hydrogen Sulfide	H <sub>2</sub> S	H <sub>2</sub> S	34.08	1,306	673



**UNIVERSITY OF PUNE**  
**[4364]-232**  
**B. E. (Petroleum Engineering)**  
**Petroleum Exploration**  
**(2003 Pattern)**

**Total No. of Questions : 6**

**[Total No. of Printed Pages :3]**

**[Time : 3 Hours]**

**[Max. Marks : 100]**

**Instructions :**

- (1) *Answers to the Questions should be written in separate answer-books.*
  - (2) *Neat diagram must be drawn wherever necessary.*
  - (3) *Assume additional data, if necessary.*
- 

**SECTION-I**

Q1. Why geophysical methods are necessary in oil exploration. Write two to three lines about each such method. What are the limitations of geophysical surveys? [16]

**OR**

Q1. Explain the term gravity anomaly. With the help of a neat diagram explain the construction and working of any one type of a gravimeter. Give details of the corrections used in gravity survey data. [16]

Q2. Answer any two of the following: [16]

- a) Give an outline of electrical methods of prospecting.
- b) Trace briefly how the oil exploration activities have changed historically with the advancement of technology.
- c) Describe the principles, construction and working of any one type of magnetometer and give methods to reduce the data. [16]

**OR**

Q2. a) Explain any one type of seismic data acquisition system. [8]

b) With a neat diagram explain the construction and working of any one type of geophone. [8]

Q3.

- a) What are the surface phenomena empirically associated with the petroleum seepages? [8]
- b) What kinds of geochemical surveys are carried out in general, for petroleum exploration? Give steps involved in a model survey. [10]

OR

Q3. Write notes on any two of the following:

- a) Geophysical and Geochemical aspects of direct detection of hydrocarbons,
- b) Soil geochemical surveys,
- c) Geochemical correlation methods. [18]

### Section II

Q4. What are the different types of detector spreads in seismic reflection surveys? Explain “Common Depth Point” method. Give its advantages. [10]

Explain mathematically how depth of a reflecting layer is calculated in seismic reflection survey assuming

- (a) Horizontal reflector and
- (b) dipping reflector. [6]

OR

Q4. Write notes on any four of the following:

- a) Time corrections applied to seismic traces,
- b) Measurement of weathered layer,
- c) Sources of energy in marine seismic surveys,
- d) Seismic reflection surveys,
- e) Noise in seismic data,
- f) Elastic properties of rocks. [16]

Q5. Write detailed notes on any two of the following:

- a) Seismic Stratigraphy,
- b) AVO technique,
- c) 4 D – seismic surveys,
- e) Migration of seismic data. [18]

Q6.

- a) What are the steps involved in delineation of the reservoirs once a discovery well is drilled. [6]
- b) What are the commonly used methods of reserves estimation and categorization at various stages of exploration? Explain the 'volumetric Estimation' method in details. [10]

OR

Q6. Write on any two of the following:

- a) Risk Analysis,
- b) Unconventional hydrocarbon resources,
- c) GIS in petroleum Industry. [16]

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**UNIVERSITY OF PUNE**  
**[4364-231]**  
**B.E.(Petroleum) Examination 2013**  
**Reservoir Engineering-I**  
**(2003 pattern)**

**Time-Three hours**

**Maximum Marks-100**

**[Total No. of Question=8]**

**[Total no. of printed pages= 2]**

**Instructions:**

- (1) Attempt any 2 questions from: Q.1 ,Q.3, Q.4 for Section-I.
- (2) Attempt any 2 questions from Q.5 ,Q.6,Q.7 for Section-II.
- (3) Answers to the two section must be written in separate answer books.
- (4) Neat diagrams must be drawn whenever necessary.
- (5) Figures to the right indicate full marks.
- (6) Use of electronic non-programmable calculator is allowed.
- (7) Assume suitable data whenever necessary.
- (8) Questions No.2 & 8 are compulsory.

**SECTION-I**

- Q.1 (a) What is reservoir engineering? (8)
- (b) Explain in detail classification of reserves and how are they calculated? (8)
- Q.2 Derive the generalized material balance equation. (18)
- Q.3 Derive the material balance equation for an oil reservoir considering rock and fluid expansion? (16)



Q.4 Find an expression for cumulative oil for different decline curves? (16)

SECTION-II

Q.5 Derive the diffusivity equation in cartesian coordinate system. (16)

Q.6 Explain the terms ETR, MTR and LTR. (16)

Q.7 Explain difference in GAS well testing. (16)

Q.8 Write a short note on a) Isochronal Test b) Pulse Testing. (18)

UNIVERSITY OF PUNE

[4364]-233

B. E. (Petroleum Engineering)

Examination - 2013

FORMATION EVALUATION

(2003 Pattern)

[Time : 3 Hours]

[Max. Marks : 100]

Total No. of Questions : 06

[Total No. of Printed Pages :3]

*Instructions :*

- (1) *Answers to the two sections should be written in separate answer-books.*
- (2) *All questions are compulsory.*
- (3) *Draw neat diagram wherever necessary.*

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**SECTION I**

Q1) Explain the logging environment in an open hole. How is wireline logging operation carried out? What are different effective depths of investigations of various logging tools? Give significance of these different depths of investigations. [16]

**OR**

Q1) Why do we need different types of resistivity tools? Describe the principle and Commonly used tools in electrical resistivity logging. [16]

Q2) Describe two important tools that are used to determine density. What will be the effects of (a) grain size, (b) barite, (c) depth of investigation, and (d) nature of source on nuclear density tools. [16]

**OR**

Q2) A) How is drilling time data collected? How is it useful in formation evaluation? [10]  
B) Write a note on sidewall coring and its applications. [06]

- Q3) Write notes on **any three** of the following: [18]
- a) Cement bond logs,
  - b) Temperature log,
  - c) Production log,
  - d) Induction log,
  - e) SP log,
  - f) Caliper logs.

## SECTION II

- Q4) A) Explain the 'quick-look' log interpretation method details. [16]

**OR**

- Q4) Answer the following: [16]

- a) What are the different physical properties of clays that are relevant to log Interpretation?
- b) Explain the empirical relationship between water resistivity, porosity and water saturation.
- c) Explain important types of cross plots and their applications
- d) What are the different methods of calculating reservoir parameters?

- Q5) Explain the terms: [16]

- a) Movable hydrocarbons, and b) residual oil saturation. How are they determined?

**OR**

- Q5) Explain in details uses of logging surveys in various stages of petroleum exploration in an area. [16]

- Q6) A) Write a detailed note on 'Mud logging' [10]

B) Give a quick look interpretation and geological interpretation of the logs given [08] in the figure 1. Assume logically significant additional data and state values clearly. Calculate Sw.

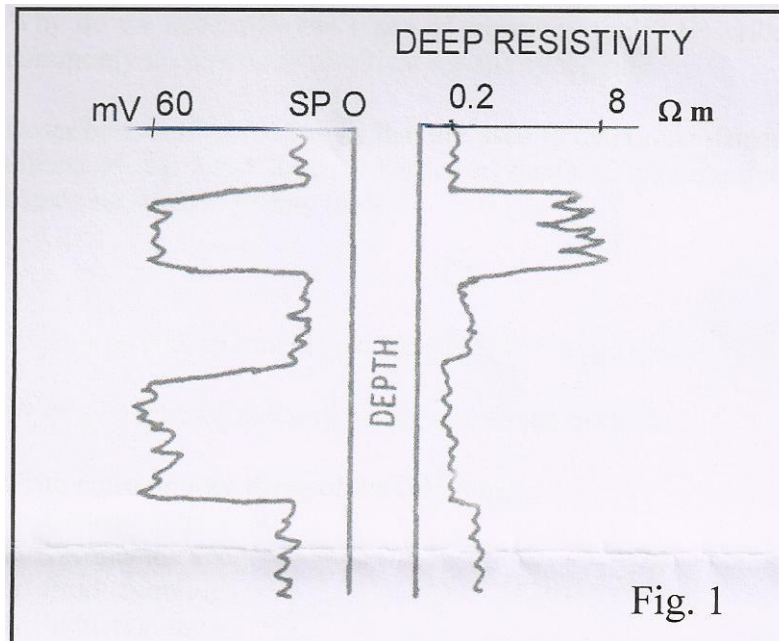


Fig. 1

**OR**

- Q6) Write notes on any two of the following:
- MWD
  - LWD
  - Logging problems in deviated wells and geosteering.
  - Overpressure in the formation.

**UNIVERSITY OF PUNE**  
**[4364]-235**  
**B. E.(Petroleum Engg.)Examination - 2013**  
**REFINING AND PETROCHEMICAL TECHNOLOGY**  
**(ELECTIVE I)(2003 Pattern)**

[Total No. of Questions:12]  
[Time : 3 Hours]

[Total No. of Printed Pages :2]  
[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) Assume suitable data, if necessary.

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**SECTION-I**

- Q1 a) Write a note on the composition of crude oil. [8]  
b) Define Cloud point and pour point. Give their significance. [8]
- Q2 a) Write a note on the electrostatic desalting process for crude oil. [8]  
b) Discuss the various types of FCC processes. Draw a neat labeled diagram of a typical FCC process. [8]
- Q3 a) Describe the process of propane deasphalting for lube oil. [8]  
b) Discuss the process of delayed coking in detail. [8]
- Q4 Write short notes on **any three** of the following. [18]  
a) Prospects of Petroleum industry in India.  
b) Reactions in catalytic reforming.  
c) Dewaxing of lube oil.  
d) ASTM distillation

**SECTION-II**

- Q5 a) Describe the process of steam cracking of olefins. [10]  
b) Describe the brief the various feedstocks used for the manufacture of petrochemicals. [6]
- Q6 a) Describe the process of manufacture of ethylene oxide from ethylene and oxygen. [10]

- b) Mention the handling precautions and applications of acetone. [6]
- Q7 a) Describe in brief the process of manufacture of Nylon-6. [8]
- b) Discuss with a neat flowsheet the conversion of ethyl benzene to styrene. [8]
- Q8 Write short notes on *any three* of the following. [18]
- a) Separation of aromatics.
- b) Manufacture of Vinyl Chloride monomer (without flowsheet).
- c) Melamine formaldehyde resin.
- d) Applications of acetaldehyde and acrylonitrile.

**UNIVERSITY OF PUNE**  
**[4364]-239**  
**B. E. (Petroleum) Examination - 2013**  
**PETROLEUM PRODUCTION ENGINEERING-II**  
**(2003 Pattern)**

[Total No. of Questions: 12]

[Total No. of Printed Pages : 2]

[Time : 3 Hours]

[Max. Marks : 100]

**Instructions :**

- (1) Attempt Section I : Q1 or Q2, Q3 or Q4, Q5 or Q6 and Section II: Q7 or Q8, Q9 or Q10, Q11 or Q12
  - (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.
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**SECTION I**

Q1	A	Draw typical schematic graph and write the procedure to determine the depth for point of gas injection, in continuous gas lift.	10
	B	Draw the schematic sketch of any one type of gas lift valve and explain its features.	08
<b>OR</b>			
Q2	A	Write the various suitable parameters and situations in which you will select SRP, Gas lift and ESP	12
	B	Draw the schematic sketch of various stages of continuous or intermittent gas lift system. Indicate all the features.	06
Q3	A	Explain the working principle and operation cycle of 'plunger lift system'.	10
	B	Explain the working of progressive cavity pumping system.	06
<b>OR</b>			
Q4		Draw the schematic sketch of surface and subsurface layout of ESP installation and explain the working of any four components of it, in detail.	16
Q5	A	Explain the SRP dynagraph in brief	06
	B	Describe the design considerations of SRP system.	10

**OR**

- |    |   |   |    |
|----|---|---|----|
| Q6 | A | Discuss the working of Sucker Rod Pumping system in detail. | 12 |
|    | B | Write the general operational problem of SRP.               | 04 |

**SECTION II**

- |    |   |   |    |
|----|---|---|----|
| Q7 | A | Write the various methods to evaluate well productivity.<br>Explain any one in brief. | 09 |
|    | B | What is formation damage? Explain the methods to overcome it.                         | 09 |

**OR**

- |    |   |  |    |
|----|---|--|----|
| Q8 |   | Write any four workover problem and their solution in brief                | 18 |
| Q9 | A | Draw the schematic sketch of any one method of well completion.            | 06 |
|    | B | Discuss paraffin and scale deposition problem and solution of it in brief. | 10 |

**OR**

- |     |   |  |    |
|-----|---|--|----|
| Q10 | A | What is petroleum production system? Discuss in brief how nodal system analysis is useful in the evaluation of petroleum Production system. Write its advantages.                                | 08 |
|     | B | What are the reasons of sand production through the wellbore? Write the various problems associated with it.   | 08 |
| Q11 | A | Write the various types of pumps used in production facility and explain working of any one in brief.  | 08 |
|     | B | Give the names of various equations governing flow through pipe lines and porous medium. State and explain any one equation used to calculate pressure drop through pipe lines or porous medium. | 08 |

**OR**

- |     |  |   |    |
|-----|--|---|----|
| Q12 |  | List various methods of transportation of oil and gas. Explain pipe line transportation and its design considerations in detail | 16 |
|-----|--|---|----|



[Total No. of Questions: 08]

[Total No. of Printed Pages: 4]

**UNIVERSITY OF PUNE**  
**[4364]-698/241**  
**B. E. (PETROLEUM ENGINEERING) Examination - 2013**  
**PETROLEUM ECONOMICS**  
**(2003 and 2008 Course)**

[Time: 3 Hours]

[Max. Marks: 100]

**Instructions:**

- 1 Answers to the two sections should be written in separate answer-books.
- 2 Black figures to the right indicate full marks.
- 3 Use of semi log graph paper is allowed
- 4 Assume suitable data, if necessary.
- 5 Answer any three questions from Section I and any three questions from Section II

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**SECTION I**

- Q.1 A) Following are the details of oil production from a well. Plot the information on suitable graph extrapolate time required to decline to economic limit of 500 BOPD [15]

Month	BOPD	Month	BOPD
1	540	13	2160
2	5000	14	2050
3	4800	15	1910
4	4100	16	1790
5	3900	17	1700
6	3600	18	1620
7	3300	19	1550
8	3100	20	1500
9	2900	21	1410
10	2650	22	1370
11	2400	23	1300
12	2350	24	1280

Describe the pattern of declining in production. What is the OOIP, if original recovery of oil was 22% If production reaches to 500 BOPD then what is the total production of oil with recovery percent?

- B) Write a detailed note on guidelines given by SPE and UN for the evaluation of petroleum reserves and resources [10]

OR

- Q.2 A) An oil field is estimated to have total reserves amounting to be 800,000 bbl. The performance prediction trend has shown a graph of an initial rate of 400 BOPD to an economic limit of 30 BOPD. Calculate the total [15]

time on production assuming. successively the following values of parameter b: (a) b= 0 (b) b= 0.5 and (c) b = 1.0

- B) Write in brief about following [10]
- 1) Reserves Auditing
  - 2) Oil differential

- Q. 3 A) The company management has opportunity of investing \$50 million in an oil field with low risk, which has economically producing capacity of 12 years. The project would require an investment of \$ 5 million at year 5 and again at year 10 of \$ 5 million. Annual maintenance cost would be \$ 1 million throughout the tenure of the project. The interest rate for the first eight years is 10%, and for the last four years will be 12%. [15]

What is the present worth of this cash flow? Draw a cash flow diagram for the above data

- B) Write notes on any two of the following [10]
- a) Investment Yardsticks,
  - b) Sensitivity Analysis,
  - c) Reserves to Production ratio (R/P)
  - d) Key international benchmark grade of oil

OR

- Q. 4 A) The project under consideration requires an investment of \$ 120,000 which will result in the cash flow generation for next five year as \$ 40,000, \$ 50,000, \$ 30,000. \$ 30,000 and \$ 20,000 respectively. Calculate the NPV at 10% and also the DCFROR for the project. [15]

- B) Write a note on Production and Demand of hydrocarbons in India [10]

**SECTION II**

- Q. 5 A) Write notes on any two of the following : [10]
- 1) Profitability in projects and equivalence of field size in different countries within the framework of Production Fiscal System
  - 2) Expected Monetary Value , EMV
  - 3) Depreciation and depletion
  - 4) Production sharing contract

- B) A drilling company is considering bidding on a \$ 150 million turnkey drilling contract for offshore oil wells. The company estimate that it has a 65% chance of winning the contract. It has three alternatives available [15]

- 1) use the existing rig to drill the wells
- 2) by a new rig
- 3) subcontract the drilling to another drilling company

Subcontracting is allowed in the fiscal documents. Probabilities and payoffs of each operations is given in following table

	Probability	NPV (million dollars)
Using existing facility		
High profit	0.35	60

Medium profit	0.45	30
Low profit	0.20	-20
Buying new rig		
High profit	0.55	35
Medium profit	0.35	25
Low profit	0.10	-10
Subcontract		
Medium profit	1.0	30

The cost of preparing the contract proposal is \$ 1 million. If the company does not bid on this tender, it has an opportunity to make a guaranteed profit \$ 10 million elsewhere.

Construct a decision tree for this situation and advise the contractor about decision with proper justification and all calculations.

OR

- Q. 6      A) An asset was purchased for \$ 96,000 with an estimated service life of 10 year and has a salvage value of \$ 12,000. Calculate its depreciation using straight line (SLD) and double declining (DDB) method. Prepare a plot of value against number of years and compare the result obtained by different results. [15]
- B) A company is planning to drill a well. The company professionals estimate that there is a 65% chance that the well will be a producer and 35% change that it will be a dry well. If the well is successful, it is estimated that there is 60% chance that the well will have reserves of 30,000 barrels, 30% chance of 60,000 barrels and 10% chance of 90,000 barrels and NPV corresponding to each reserves value will be \$ 60,000 \$120,000 and \$ 150,000 respectively. The dry well cost is \$ 65,000. Draw a decision tree and give decision with proper justification. Preserve all calculations. [10]
- Q. 7      A) Construct a critical path study to develop a medium size field for which details are given below: [15]
- 1) Sixty development wells (\$1.5 MM each)- one third will be injectors.
  - 2) Three platforms – two for wells, the other for production/injection equipment and pipeline terminus. (\$ 310 MM each).
  - 3) Well take about one month to drill. Up to two rig / platform
  - 4) Platforms manufactured in one and a half years- two out time one month during weather window in summer (Two out costs \$ 10 MM0). Setup time is three months for drilling/ well platform.
  - 5) Pipeline lay time is about 14 months. (Cost \$ 180MM)
  - 6) Production “commissioning” and final permit take two months. (\$ 5 MM)
  - 7) Overhead and other ongoing costs = \$1 MM/ month
- The main idea of this exercise id to avoid waste of time, labor

and material

- 1) Draw a critical path diagram for this project. Assume a starting date of July, 1, 2013
- 2) Determine the time length of the critical path.
- 3) Plot cumulative costs as a function of time.

B) Write a detailed note on Petroleum Accounting system [10]

OR

Q. 8 A) Use following production data for calculation. [25]

Year	BOPD	Year	BOPD
1	1050	9	1351
2	1170	10	1183
3	1305	11	1037
4	1455	12	908
5	1761	13	795
6	1761	14	697
7	1761	15	610

Following are the assumption for the preparation of spreadsheet and further calculations:

- 1) Exploration and Development cost is \$ 150 million barrels which has to be spent equally in five years
- 2) Annual operating and production cost will be \$ 3.50 / barrel, which will remain constant throughout production
- 3) Production will begin in the sixth year since award of contract
- 4) Oil price will be \$ 75 per barrel and will remain constant
- 5) Royalty will be 10% of annual revenue / annual production.
- 6) Cost recovery will be 70% from first year of commercial production and profit petroleum will 30%
- 7) Profit petroleum will be shared between the contractor and government.
- 8) Contractor share will be 60% and government will take 40% oil
- 9) Time value of money is 10%
- 10) Income tax for contract will be 30% on taxable income
- 11) Calculate the contractor NPV before tax and after tax.

Show how one barrel of oil or \$ 75 will be distributed using the assumptions given above?

[Total No. of Questions: 12]

[Total No. of Printed Pages: 1]

**UNIVERSITY OF PUNE**

**[4364]-243**

**B. E.(Petroleum Engineering ) Examination - 2013**

**DEEPWATER TECHNOLOGY (2003 Course)**

**[Time: 3 Hours]**

**[Max. Marks: 100]**

**Instruc  
tions:**

*All questions are compulsory.*

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**SECTION –I**

- Q.1 Give classification on offshore structures And Explain all in Detail. [25]
- Q.2 What is station keeping? What are different methods of station keeping? Explain in detail with suitable sketches. [25]

**SECTION –II**

- Q. 3 Explain installation procedure for offshore platforms with suitable sketches. [20]
- Q. 4 Write in detail about motion compensator. [10]
- Q. 5 Explain marine risers used in production operation. [10]
- Q. 6 Explain offshore strong, handling and transportation of oil and gas. [10]