UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M. Tech(Petroleum Engineering) **Semester –**

Subject (Course): Reservoir Engineering **Max. Marks : 100**
Course Code : PEAU7002 **Duration : 3 Hrs.**
No. of page/s: 3(Three)

THIS PAPER CONTAINS 3 (THREE) SECTIONS, ALL THE SECTIONS ARE COMPULSORY

(Assume any missing value)

SECTION - A

There are Five (05) questions of 4 marks each. All questions are compulsory

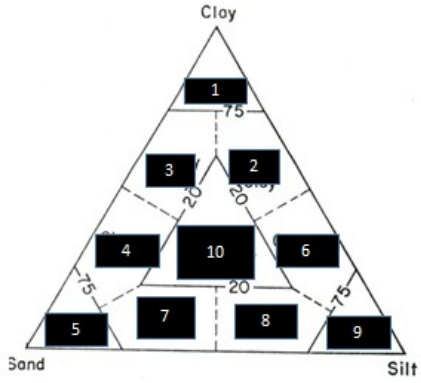
Question-1

Indicate the following:

(i) Eight steps of petroleum operations in oil industry.
(ii) Three essential conditions describing the Hydrocarbon reservoir.
(iii) Three types of hydrocarbon producing wells.
(iv) Three basic requirements of hydrocarbon recovery.
(v) Three basic geological steps hydrocarbon occurrence.

Question-2

If a reservoir comprises different percentage of sand, clay and silt as per the composition given in figure-1 below, name all the 10 elements.



Question-3

Express your comments for reservoir porosity with special reference to following:
Geometric character of rock,
Mechanical properties of rock and
Reservoir Heterogeneity

Question-4

(a) Fill in the blanks;

(i) ---------- is a directional (scalar) property

(ii) ---------- highest parallel to the long axis of grains as the deposition occurs with alignment of the long axis of grains due to parallel current.

(iii) Vertical ---------- (perpendicular to bedding plane) may be reduced by the shale laminations in sands or stylolite in carbonates.

(iv) ---------- are a source of Directional or Secondary permeability.

(b) Using Timur equation, estimate the absolute permeability to oil zone with a connate-water saturation and average porosity of 25% and 19%, respectively.

Question-5

Discuss the impact of fluid saturation on reservoir performance. Also differentiate between critical saturations and average fluid saturation.

Section B

There are Four (4) Questions of 10 marks each. All the questions are compulsory

Question-6

(a) Discuss the existence of Capillary Pressure in hydrocarbon reservoir. Also describe the characteristic features of a capillary pressure curve with the help of core flooding experiment.

(b) Calculate the pressure difference, i.e., capillary pressure, and capillary rise in an oil-water system from the following data:

$\theta = 30°$ $\quad \rho_w = 1.0\ gm/cm^3$ $\quad \rho_o = 0.75\ gm/cm^3$

$r = 10^{-4}\ cm$ $\quad \sigma_{ow} = 25\ dynes/cm$

Question-7

Indicate the inter-relation of reservoir fluids between surface and sub surface. Also discuss classification of Hydrocarbon Reservoirs on the basis of compositional analysis.

Question-8

(a) Brief the various sources of reservoir pressure. Also discuss the concept of anomalous pressure in hydrocarbon reservoirs.

(b) "If two or more fluid pressure measurements are required to be on made in a hydrocarbon reservoir, the utility/availability of data is time specific as well as frequency specific"

In view of above, *please, indicate the various possibilities of Pressure Measurements in an oil/gas field and also indicate briefly the sequence of activities related to Field Pressure Measurements.*

Question-9

Describe the objectives of Petroleum Resources Management System also differentiate between Contingent and Prospective Resources

Section C

There are Two (2) Questions of 20 marks each. Both the questions are compulsory

Question-10

(a) What are the stages of hydrocarbon reserve estimation and also discuss the principle &data source of Volumetric Method of in place hydrocarbon determinations.

(b) Calculate

1. Volume of oil in place in standard condition
2. Volume of oil with relative error of 5% in each parameter in a reservoir with the following data:

(i) $Vr = 1.96 \times 10^9\ m^3$ (ii) hu/ht= 0.85 (iii) $\phi = 0.18$ (iv) $S_w = 0.75$ and (vi) $B_o = 1.34$

Or

(a) Highlight characteristics of Decline Analysis with special reference to exponential decline and establish the following relation

$$q = q_i\, e^{(-a\,t)}$$

(b) Determine the reserves and estimate in place hydrocarbons in a reservoir having exponential decline and the relation between - flow rate(q stb/d) and cumulative production (N_p MSTB) as under:

$q = 0.4301 \times Np + 5768.7$

You may please, take the Economic limit of production as - 1000 STB. /day

Question-11

Which drive mechanism is predominating at early stage of oil production? Describe its characteristics and development scenario, Also calculate the oil produced from the under saturated reservoir with S_{wi} =25% and in place reserves of 100×10^6.The reservoir has indicated a depletion of 1400psi. The additional data as follows:

$B_0 = 1.50, B_{oi} = 1.53, C_o = 14 \times 10^{-6}$ psi,$^{-1}$ $C_p = C_w = 4 \times 10^{-6}$ psi $^{-1}$ and $C_e = 20.7 \times 10^{-6}$ psi^{-1}

End of Paper-1

Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M. Tech(Petroleum Engineering) **Semester –**

Subject (Course): Reservoir Engineering **Max. Marks : 100**
Course Code : PEAU7002 **Duration : 3 Hrs**
No. of page/s: 3(Three)

THIS PAPER CONTAINS 3 (THREE) SECTIONS, ALL THE SECTIONS ARE COMPULSORY

(Assume any missing value)

SECTION - A

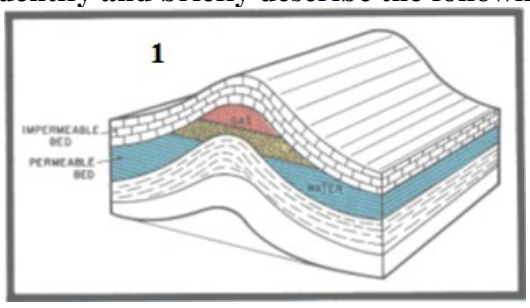
There are Five (05) questions of 4 marks each. All questions are compulsory

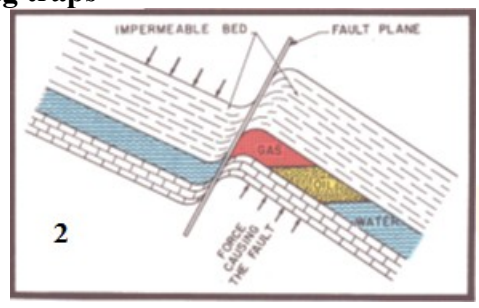
Question-1

(i) Indicate various stages of reservoir management from exploration to abandonment.
(ii) Indicate the three types of hydrocarbon producing wells.
(iii) Indicate the exploration nomenclature to the well that has given only water.
(iv) Indicate the different types of geological pressure gradients.
(v) Indicate the three types of fluid pressure gradients.

Question-2

Identify and briefly describe the following traps





Question-3

Describe various types of geologic porosities.

Question-4

(a) Discuss the Permeability of porous media and its fundamental characteristics. Also differentiate between –absolute, effective and relative permeability

Question-5

Enlist the various methods that can be used for fluid saturation. What method you would like to adopt for determination of fluid saturations please discuss the merits and limitations for the same method.

Section B

There are Four (4) Questions of 10 marks each. All the questions are compulsory

Question-6

(a) Discuss the existence of Capillary Pressure in hydrocarbon reservoir. Also describe the types of capillary pressure and other vital relation associated with it.

(b) Characteristic features of a capillary pressure curve with the help of core flooding experiment. Also calculate the pressure difference, i.e., capillary pressure, and capillary rise in an oil-water system from the following dataCalculate the pressure difference, i.e., capillary pressure, and capillary rise in an oil-water system from the following data

$r = 10^{-4}$ cm $\quad \sigma^{ow} = 52$ dynes/cm

$\theta = 30^{\circ}$ $\quad \rho_w = 1.0$ gm/cm^3 $\quad \rho_o = 0.52$ gm/cm^3

Question-7

Why the PVT analyses constitute an integral part of reservoir engineering studies? Also describe the properties and phase behavior of different types of oil reservoirs

Question-8

Differentiate between hydrostatic pressure gradient and hydrodynamic pressure gradient or fluid potential gradient discuss their significance and application in single well scenario. Also calculate compaction pressure If all pores filled with water of a sedimentary basin, comprising of natural specific gravity given as under:

- **Sand stone----------→ 2.1**
- **Shale----------→ 2.3**
- **Lime----------→2.4**

Question-9

Differentiate between Contingent and Prospective Resources .Also express the concept of LKH (Lowest known hydrocarbon) and the possible flexibilities existing in industry from resource/reserve description point of view.

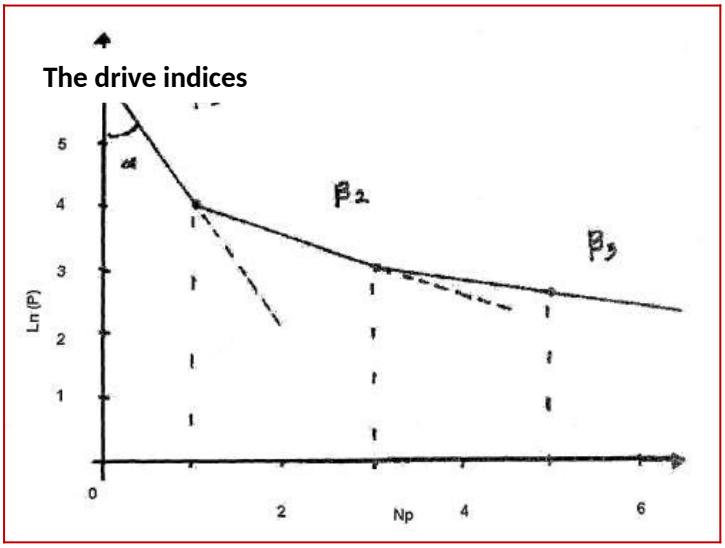
Contd. On page-3

Section C

There are Two (2) Questions of 20 marks each. Both the questions are compulsory

Question-10

What do you understand by drive indices in an oil reservoir, Differentiate between performance of volumetric reservoirs and water drive reservoirs.
Also interpret the figure "the drive indices" given below:



Or

Discuss the gas well monitoring from techno-analytical point of view.
What do you understand by "Water saturation profile of a reservoir of capillary pressure in hydrocarbon reservoir"? Discuss the same with respect to following conditions:

(a) Pore-size distribution (b) Gas, Oil, and Water distribution.

Question-11

Describe the following problems:

(i) Compressibility Factor:
(ii) Formation Gas Oil Ratio , Production Gas Oil Ratio & Solution Gas Oil Ratio:
(iii) Oil Formation Volume Factor & Gas formation Volume Factor.
(iv) Shrinkage factor

(v) Specific Gravity of liquid

End of Paper-2