UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M. Tech **Semester –I**
Subject (Course): Methods in Petroleum Exploration **Max. Marks : 100**
Course Code : PEGS7002 **Duration : 3 Hrs**
No. of page/s:3

(Draw correct diagram whenever necessary)

SECTION A (Attempt all)

4x5=20

1. **Multiple choice questions:**

a) Which of the following formation is prospective for CBM exploration?
   i. Cambay ii. Kalol
   iii. Raniganj iv. Barren Measure

b) Which one of the following features is NOT associated with sedimentary rocks?
   i. Bedding ii. foliation
   iii.. Fossils iv. all may be associated with sedimentary rocks

c) The natural gas gamma log measures the
   i. Uranium, ii. Thorium and uranium, iii. Nickel, iv. All

d) According to Wentworth's scale, particles having a diameter between 64mm to 4mm are described as
   i. Granule ii. Pebble
   iii. Cobble iv. Coarse sands

e) The most compact packing in a sedimentary rock having minimum porosity is
   i. Cubic packing ii. Conical packing
   ii. Rhombohedral packing iii. Spherical packing

2. Discuss the role of buoyancy in hydrocarbon migration.
3. Explain why the source rock shows more vitrinite reflectance value with increasing maturity.
4. What is the maximum fold of a seismic data using 96 receivers with geophone interval half of the shot interval?

SECTION- B [40marks]

[4x10=40marks]

5. (a) Enumerate the tools and equipment required to undertake geological mapping.[4]
   (b) Discuss the importance of subsurface mapping in petroleum exploration. [6]

6. (a) Discuss hydrocarbon promising depositional environment in reference to sediment transporting processes and sediment characteristics.[5]
   (b) In which environment you will get best source rock and reservoir quality? [5]

7. (a)What are the processes of sedimentary basin formation? [5]
   (b) Draw a flowchart to represent the basin types and explain with suitable examples.[5]

8. What is the difference between cap rock and reservoir traps? Discuss different types of stratigraphic traps. [3+7]

[or]

What is primary migration? Elaborate the mechanisms of primary migration. [2+8]

SECTION – C [40marks]

9. Refer the following table which presents Rock Eval Pyrolysis data [6+4+5+5]

Sample ID	S1	S2	S3	TOC	Tmax
1	0.3	12.5	0.8	13	444
2	1.84	18.4	0.57	20	445
3	0.98	7.9	0.56	9	446
4	0.34	6.6	0.34	7	447
5	0.22	6.3	0.41	6	448
6	1.94	5.98	0.45	8	449

a) Calculate the production index, hydrogen index, oxygen index for the studied samples.
b) Interpret the organic richness and kerogen types.
c) Discuss the thermal maturity of the source rock.
d) Give your comment on the source rock potential

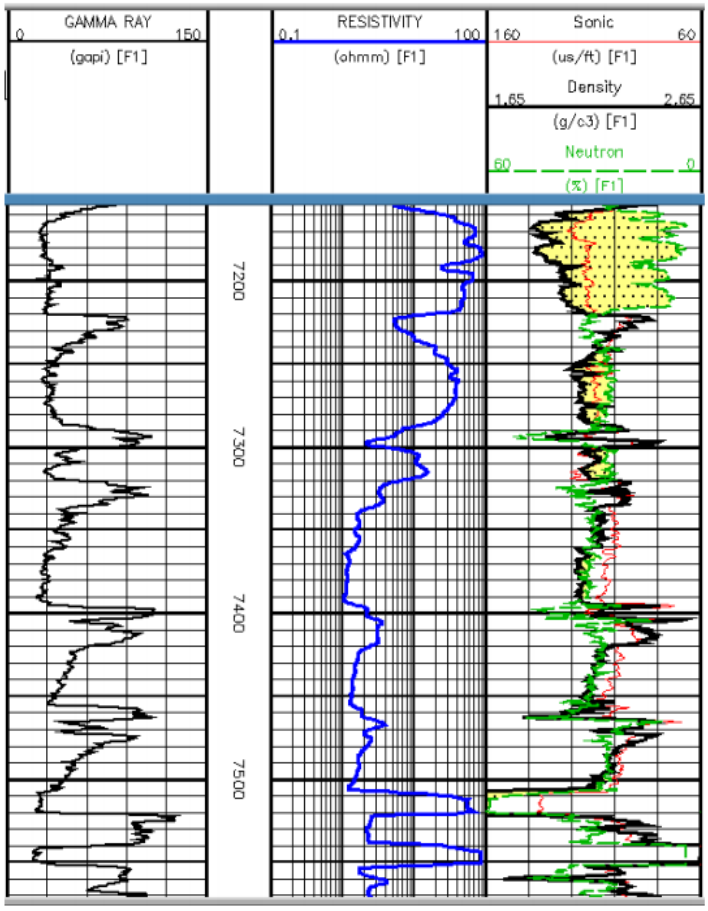
10. "A geological model is a spatial representation of the distribution of sediments and rocks in the subsurface." [5+5+10]
(a) How the seismic waves in rocks play role in petroleum exploration? Analyze the integrated seismic and well log methods in geological modelling.

(b) How will you assess the reservoir quality and quantity using well logging techniques?

(c) In a clean sandstone formation ρb is the measured bulk density 2.23 gms/cc, ϕe is porosity in fraction, ρf is fluid density in gm/cc and ρma is matrix density for appropriate lithology. If we assume ρf to be equal to 1gm/cc for water, then by measuring bulk density of clean water bearing formations derive the porosity of the rock.

[or]

Refer the following well log profile and answer the following questions



a) Demarcate the sandstone layers (mention the depth)

b) Calculate the clay volume for depth zone of 7290-7300m

c) Interpret the reservoir zones and assess the presence of hydrocarbon qualitatively

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SECTION- A [20marks]

(Attempt all questions)

[4X 5= 20]

1. Discuss the role of diffusion and capillary pressure in hydrocarbon migration.
2. What are the tools and equipment required to undertake geological mapping. Explain the importance of geological mapping.
3. Explain the role of fault in petroleum exploration?
4. Define isopach, isochore, isolith and isopay maps. Explain the utility of those maps in petroleum exploration as well as reserve estimation.

SECTION- B [40marks]

[4x10=40]

5. What is secondary migration? Explain the mechanisms of secondary migration.[1+9]
6. What is well log? Explain how geological parameters can be evaluated using well logs.[2+8=10]
7. Discuss the different stratigraphic reservoir traps.[10]
8. List the petroliferous sedimentary basins in India. Explain the petroleum system and production history of any basin. [5+5]

[Or]

Discuss the sedimentary basin formation processes with respect to global tectonics. [10]

SECTION – C [40marks]

9. Refer the following table which presents Rock Eval Pyrolysis and answer the question.

Sample ID	S1	S2	S3	TOC	Tmax
A	0.11	4.53	0.33	4.97	449
B	0.33	2.57	0.85	3.75	450
B0	0.4	4.12	0.61	5.13	453
B1	0.44	4.08	0.68	5.2	454
B2	0.41	3.66	0.74	4.81	455
B4	0.55	4.64	0.58	5.77	457

e) Calculate the production index, hydrogen index, oxygen index for the studied samples.[7]

f) Interpret the organic richness and kerogen types.[3]

g) Discuss the thermal maturity of the source rock and construct the van Kevalan diagram.[6]

h) Give your comment on the source rock potential.[4]

10. In geology, depositional environment or sedimentary environment describes the combination of physical, chemical and biological processes associated with the deposition of a particular type of sediment in marine, continental and transition environment.

a) Discuss hydrocarbon promising depositional environment in reference to sediment transporting processes and sediment characteristics. [10]

b) Where you will get best reservoir quality? Justify your answer. [5]

c) What are the parameters to assess in basin modelling? [5]

[or]

"In this ever-changing economic and political climate, petroleum explorationists and field development geologists are being asked to find more oil and develop older reserves".

a) Evaluate the diagnostic tools used for petroleum exploration. [3]

b) Analyze the geophysical techniques for petroleum exploration.[10]

b) What is your role as petroleum engineer to find oil and gas? [7]