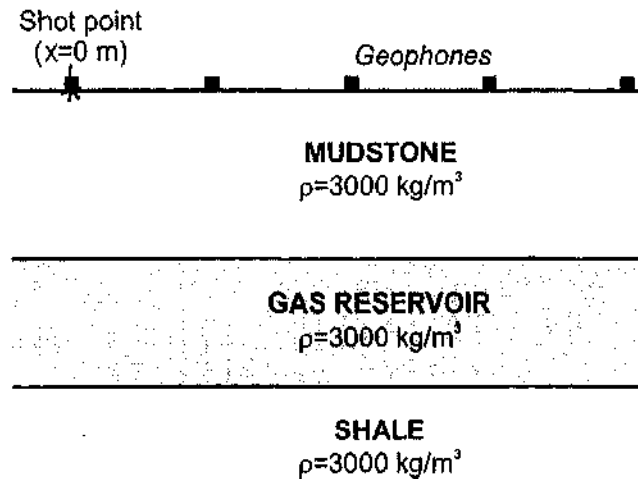


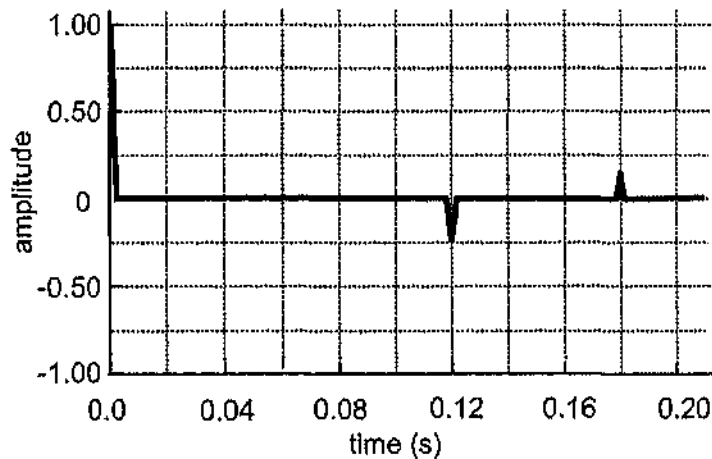
"The petroleum system concept is important for taking advantage of similarities in HC plays in different geographical locations. A petroleum system can be defined as all those geologic elements and processes that are essential for HC trapping and an HC accumulation exists"--- How do you respond to these statements. In the process of your enunciation elucidate the various elements of a HC play in a hierarchically organized manner. Also illustrate the main source rock types and their origin.

(8)

4. The following seismic reflection data was collected over a hydrocarbon reservoir. A schematic diagram of the subsurface geology is given below.



The zero-offset trace is shown below, which contains the direct wave and the reflections from the top and bottom of the reservoir. The data table gives the arrival times for the reflection from the top of the reservoir.



Offset (m)	Arrival time (s)
0	0.119658
40	0.120873
80	0.124446
120	0.130184
160	0.137816

In your analyses, assume that:

the upper and lower boundaries of the reservoir are horizontal,
the seismic source has an initial amplitude of +1,
the geometrical spreading, attenuation and scattering can be neglected,
the reservoir is made up of sandstone matrix (2500 m/s) and gas pore fluid (300 m/s).

- a) What is the velocity of the mudstone layer above the gas reservoir?
- b) How deep will we have to drill to get to the top of the gas reservoir?
- c) What is the seismic velocity of the reservoir?
- d) What is the porosity of the reservoir?
- e) What is the thickness of the reservoir?
- f) What does the seismic data indicate about the properties of the shale layer below the gas reservoir? Explain.

(11)

5. *“Seismic sequence analysis has the potential of indicating both the local and the regional tectonic behavior”* - Justify this statement with suitable examples. Your illustration is expected to throw light on the close relationship amongst the tectonic setup, sediment transportation and deposition, sea level rise and fall with respect to the depositional surface, paleo-environment and the Strandline movement. How is Seismic Facies mapped? Give an illustration.

(8)

6. *“One of the more important interpretative aids that are available to seismic stratigraphers is the ability to produce seismic models”* – In agreement with this statement build a case for utilizing the concept and algorithms of seismic modeling both forward – 1D, 2D & 3D and inverse approaches for strengthening high resolution seismic stratigraphic interpretations directly or in-hybridization with well seismic and other logging cross plots. In the course of your discussion highlight the probable pitfalls associated with this kind of correlation processes. Give comparative analysis between the seismic parameters and the equivalent geological insights.

Illustrate the fundamental principles of 4D Seismic Technology and its utility in reservoir production monitoring.

(8)

7. What is a *“Thin bed”*? *“Widess Diagram helps in resolving thin beds through amplitude and time thickness cross plotting”*- There are various calibration charts available to this effect. Give schematic illustrations of (a) effect of bed thickness on reflection wave shape; (b) Typical detection and resolution of bed thickness from Zero phase seismic data. Define the principal features of a calibration chart that is generally used for both linear and quasi-linear relationship between the peak-to-trough amplitude curve and actual bed thickness in contrast with the tuning thickness.

(8)

8. *“Reservoir modeling gives possibility to compare the well data and the expected seismic response. Changing the reservoir model results in a suite of output, whereby the sensitivity to certain reservoir is highlighted.”* –Drawing possible relationship between the linearised Zoeppritz approximations with some rock physical parameters establish the validity of this statement.

Estimate V_p and V_s velocities in km/s that are needed for an elastic inversion. Use Castagna's formulation and consider the constants as, $a=0$, $b= 0.804$, $c= 0.856$ for Sand, and $a=0$, $b=0.770$, $c=0.867$ for Shale.

How is the reservoir and trap parameters quantified?

Enumerate the "*Quantitative assessment*" of a probable Hydrocarbon prospect. How is the volume of recoverable hydrocarbon assessed?

How is the Fluid Factor derived from AVO analysis? Based on the AVO attributes classify a seismic reservoir.

(10)

9. "*Four major groups of systematic reflections are distinguished on seismic sections*" - What are those, illustrate with appropriate examples & neat sketches.

Discuss in brief the interrelationship between the system tracts and depositional geometries. Stretching it further how could you explain Hydrocarbon habitat especially the depositional settings that favor source rock development.

"*Seismic data are scanned for DHIs, which stands for Direct Hydrocarbon Indicators*" - Give a comprehensive description of all the probable DHIs that a migrated seismic section could provide under various structural/stratigraphic settings of a potential hydrocarbon reservoir. Enumerate the pitfalls associated with these Direct Hydrocarbon Indicators.

(4+5+5=14)

10. Write explanatory notes on

(3 x 3 = 9)

- a) Lithostratigraphy and Allostratigraphy
- b) Eustatic versus tectonic controls on sedimentation
- c) Marine sequence stratigraphy

11. a) With the help of a neat diagram show a generalized dip-oriented cross-section through a divergent continental margin, illustrating the overall subsidence patterns and stratigraphic architecture. Show the time lines.

(4+2 = 6)

- b) What are sequence stratigraphic surfaces?

(5)

OR

- i) With the help of a neat diagram show the patterns of sedimentation across a foreland basin. (6)

- ii) Discuss the sedimentary facies package developed on delta front and prodelta system. Discuss the method of facies analysis within such a system?

(5)

..... End.....