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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, April 2018

Program: B. Tech. APE UP
Course Name: Enhanced Oil Recovery
Course Code : PTEG 427
No. of page/s: 3

Semester – VIII
Max. Marks : 100
Duration : 3 Hrs.

Instructions:

- Answers must carry the supporting material such as equations and diagrams
- Abbreviations used in the questions are standard and have their usual meaning
- Make appropriate assumptions where data is not supplied

SECTION A

Answer all five questions. Each Question carries 4 Marks 5x4= 20 Marks

- Question 1** Explain Wettability, Compressibility, Relative Permeability and Free Water Level. (4 Marks)
- Question 2** Explain Aquifer, Size of Gas Cap, Drive Mechanism and Cusping. (4 Marks)
- Question 3** What are the different screening criteria for N₂ & Flue Gas Flooding, Hydrocarbon Miscible Flooding and CO₂ Flooding Methods? (4 Marks)
- Question 4** Write the definitions of Bypassed oil, fluid pressure, hydrodynamic pressure and rock pressure. (4 Marks)
- Question 5** What is Reserve? Explain Probable, Possible and Proved Reserves. (4Marks)

SECTION B

Answer all five questions. Question No. 1 to 4 are compulsory. Answer any one question from Questions No.5. Each Question carries 8 Marks 5x8= 40 Marks

- Question 1** Write down the general MEOR mechanism. What are the Reservoir and well selection criteria? Write down the case studies of MEOR processes developed in India. (8 Marks)

- Question 2** Write down the screening criteria and limitations of Polymer Flooding methods. Write down the parameters on which viscosity of polymer solution depends. Write down the two names of commercial polymer. (8 Marks)
- Question 3** What are Water Flooding aspects? Why pressure maintenance is essential in Depletion Drive Reservoir. Explain Simultaneous Gas and Water coning with suitable Figures and Formulas. (8 Marks)
- Question 4** What is Volumetric Method? Explain the calculation of oil in place and gas in place by Volumetric Methods. What are the advances in EOR? Explain different types of Simulators for Enhanced oil recovery processes. (8 Marks)
- Question 5** Explain Well Spacing, Different rule of well Spacing, Direct Line Drive, Staggered Line Drive, Peripheral Flood Pattern, Five Spot and Central Line Pattern with suitable Figures. (8 Marks)

OR

- Question 5** Explain different types of Decline Curve Analysis in detail with suitable Figures.

Calculate the Productivity Index and Production rate of a horizontal well with the following data:

Length of lateral, ft, =3500

Bottom hole flowing pressure, psi=1350

Formation Permeability, mD=20

Estimated drainage area, acres, =160

Average pressure of the drainage area, psia, =2250

Radius of wellbore, ft, =0.42

Average formation thickness, ft, =60

Viscosity of oil cp, =1.2

Oil formation volume factor, rb/stb, =1.24

Assume the porous medium in which the well is drilled is uniform and isotropic

(8 Marks)

SECTION C

Answer all two questions. Question No. 1 is compulsory. Answer any one question from Questions No.2. Each Question carries 20 Marks **2x20 = 40 Marks**

Question 1 **(20 Marks)**

- 1-a** What are the different types of Miscible Recovery Method? Explain N2 Flooding Method with suitable examples and figures (10 Marks)

- 1-b** Calculate the oil consumed after 5 years of in situ combustion developed as a primary recovery method. The oil reservoir (SG=0.950) has 157×10^6 bbl OOIP reserve, and the combustion process is sustained by the injection of 700×10^3 ft³ air/day through each of the 12 injection wells. (10 Marks)

Question 2 (20 Marks)

- 2-a** What is Surfactant Flooding Process? Explain with suitable Figure. Write down the Screening criteria and applications of surfactant Flooding Method. (5 Marks)

- 2-b** Calculate the water breakthrough using the Sobocinski-Cornelius method for a vertical well producing at 250 STB/day. The following reservoir data are available:

$$Q_o = 250 \text{ STB/day} \quad h = 50\text{ft} \quad h_p = 15\text{ft} \quad \rho_w = 63.76\text{lb/ft}^3$$

$$\rho_o = 47.5 \text{ lb/ft}^3 \quad \mu_o = 0.73 \text{ cp} \quad B_o = 1.1 \text{ bbl/STB} \quad k_v = 9 \text{ mD}$$

$$k_h = 93\text{mD} \quad \phi = 13\% \quad M = 3$$

Using the above data also calculate critical Oil flow rate. (15 Marks)

OR

Question 2 (20 Marks)

- 2-a** What are the types of Combustion techniques? Explain in detail. Write down the mechanism of Combustion. What are the limitations and problems in In Situ Combustion Method? Write down the any case studies of successful implementation. (10 Marks)

- 2-b** A Combustion test in confined pattern conducted on a depleted oil reservoir with a current oil recovery of 15 percent. Estimate the final oil recovery expected after the commercial development of the in situ combustion method given the following:

Confined acre 1.35 acres

Net thickness 25 ft

Effective porosity 30%

Irreducible water saturation 24%

Oil formation volume factor

Initial 1.18

Current 1.10

Cumulative oil production of the central

Well P, as the effect of combustion $\Delta N_c = 12,250$ bbl (10 Marks)