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## UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B. Tech. APE UP

Subject (Course): Reservoir Modeling & Simulation

Course Code : PTEG 431

No. of page/s: 3

Semester – VII

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** What are the objectives of reservoir simulation studies? What are the uses and misuse of Reservoir Simulation model? (4 Marks)
- Question 2** What are the differences between the Classical and Numerical Simulation Methods? What are the sources of errors in a numerical model? (4 Marks)
- Question 3** What are the types of reservoir based on fluid nature? What is Black Oil Model? (4 Marks)
- Question 4** What is Simulator? What are the basic steps in formulation of Reservoir Simulator Equation? (4 Marks)
- Question 5** Define Gas Deviation Factor, and Productivity Index. Explain the Darcy's law to calculate the Productivity Index of well. (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** Define Numerical Formulations in Simulators. Explain IMPES, IMPIS and Fully Implicit Method (8 Marks)

- Question 2** What is differential equation? Write down the classification of differential Equation. Explain Partial Differential Equation. (8 Marks)
- Question 3** Define Equation of State and Diffusivity Equations. Write down the names of Iterative Methods used in Simulation Study. (8 Marks)
- Question 4** What is Model initialization in simulation? What are the Model initialization techniques? (8 Marks)
- Question 5** Write down the use of Core data Production logging data, Pressure transient data, and Open hole log data in reservoir simulations. (8 Marks)

**OR**

- Question 5** Explain finite-difference method? Explain Through Flow Diagram Overall Solution Methodology of Reservoir Simulation. (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 objectives of History Matching? What are the uncertainties in History Matching? What sort of data should be match during history match? How to Match? Write down the overall steps used in History Matching. (10 Marks)

**1-b** What are the types of Decline Curve Analysis Explain in detail?

Calculate forecasting future production with different methods of decline curve analysis for a well has an initial rate of 1250 STB/D and initial decline rate,  $d_i$ , of 5% per month. Determine the rate and production after 5 years for the following cases:

- i. Exponential ( $n=0$ )
- ii. Hyperbolic decline with  $n=0.5$
- iii. Harmonic decline ( $n=1$ ) (10 Marks)

**Question 2** **(20 Marks)**

**2-a** Explain differential form of Darcy's law for three-phase flow.

Performance of a future well under uncertainty: A likely production rates need to be estimate for a planned well in a reservoir development. A pseudo-steady flow condition is assume for wells once production I stabilized following the initial high rate. The following data, same in ranges pertaining the reservoir is available:

Average reservoir pressure prior to drilling, psia= 3250

Flowing bottom hole pressure in nearby wells, psia=2080

Drainage radius of the well, ft = 1320

Net thickness of the formation, ft = 25-29

Permeability range from core studies, mD= 15-25

Viscosity of oil, cp = 0.85-0.88

Oil Formation Volume Factor, rb/stb =1.05

Wellbore radius, ft = 0.32

Skin factor (dimensionless) = -3.0 to 3.0 (10 Marks)

- 2-b** Write down the names of modeling software for Static modeling and Dynamic Simulation. What are the criteria of simulator selection? For IMEX Simulator and Eclipse write the pre-processor and post processor files. (10 Marks)

**OR**

**Question 2** (20 Marks)

- 2-a** What is Discretization process? Write down the Discretization steps in the development of reservoir simulator. (10 Marks)
- 2-b** Explain MBE in Oil & Gas reservoirs. For a BLACKOIL system list the number of unknown and the equation required to solve for these at each time step. Explain each equation identifying the data input by the user. (10 Marks)