KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2017/2018
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN PETROLEUM ENGINEERING
EPL 504: WELL AND RESERVOIR SIMULATIONS

DATE: MONDAY 26TH FEBRUARY 2018 **TIME: 8.00 A.M. – 10.00 A.M.**

INSTRUCTIONS: **Answer ALL Questions**

QUESTION 1: (15 Marks)

A. An example of a tank model is _____

B. What is a sector Model?

C. Reservoir model designs are influenced by the following:
   i. Type and complexity of problem
   ii. Availability and quality of data
   iii. Time available for study
   iv. economic considerations
   v. All of the above

D. Grid blocks and timestep sizes of 3D models must:
   i. Identify saturations and Pressure at specific locations and times
   ii. Describe reservoir geometry, geology and properties
   iii. Describe dynamic saturations and pressure profiles in sufficient detail
   iv. Be compatible with the mathematics so that solutions are accurate and stable
   v. Satisfy all the above

E. Wells must be represented as *sinks* or *sources* in reservoir simulators

F. The mathematical model of a reservoir system requires the combination of a number of equations. List 4 equations that would be used in a thermal flood simulator.

G. Gas condensate reservoirs will be best modeled using ________ simulators

H. The challenges of data integration during reservoir modeling include the following:
   i. Data are not available at the same time
   ii. Quality of data from various sources may be different
   iii. Information may not be measured at the same scale and resolution
   iv. Some solutions are not unique and require multiple models
   v. All of the above

I. Data requirement for modeling primary oil recovery processes are:
   i. Less than those for secondary oil recovery processes
   ii. More than those of secondary oil recovery processes
   iii. Same as those of secondary oil recovery processes
   iv. Not significant
   v. None of the above

J. A reservoir is 10 miles long and 4 miles wide. A gridblock was defined with DX=DY= 1/8 mile. If five model layers are used, what is the total number of gridblocks needed in the model?

Question 2.(Total 25 Marks)

(a) Write the implicit, explicit and Crank Nicholson finite difference schemes for the following equations:

$$K\frac{\partial^2 T}{\partial x^2} = \frac{\partial T}{\partial t} \quad \text{(i)}$$

$$\frac{\partial P}{\partial t} = \frac{\partial^2 P}{\partial x^2} + \frac{\partial^2 P}{\partial y^2} \quad \text{(ii)}$$

(15 *Marks*)

(b) Using an example equation, explain what you understand by IMPES (5 Marks)

(c) Mention and explain 3 factors that can affect the accuracy of a simulation model. (5 Marks)

Question 3 (Total 10 Marks).

The following data were obtained for gas formation volume factor (Bg) at different pressures. Using the least squares method, estimate Bg at 3320 and 2800 Psia respectively. (10 Marks)

Pressure (psia)	Bg (Cu ft./Scf)
3480	0.00488844
3190	0.0052380
3139	0.0053086
3093	0.0053747
3060	0.0054237

Question 4. (Total 20 Marks)

The Fourier's Law for heat conduction in a solid can be expressed as:

$$K\frac{\partial^2 T}{\partial x^2} = \frac{\partial T}{\partial t}$$

Use the implicit finite difference method to solve for the temperature distribution of a long, thin rod with a length of 10 cm and the following values: Dx = 2cm, Dt = 0.1s. At t=0, the temperature of the rod is zero and the boundary conditions are fixed for all times at T(0) = 100 oC and T(10) = 50 oC. Assume K = 0.835 cm2/s. (20 Marks)

END