Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, June 2021

Course: Petroleum Reservoir Modelling and Simulation **Semester : II**
Program: M. Tech. Petroleum Engineering **Time : 03 hrs.**
Course Code: PEAU: 7007 **Max. Marks: 100**

SECTION A

1. **Each Question MCQ/TF will carry 5 Marks**
2. **Instruction: Select the correct answer**

Sl. No.	Question	CO
Q 1	Tick the correct answer. **Each MCQ** carries **ONE** marks. A. The physical system to be modeled must be expressed in terms of appropriate Ans.: (a) Numerical Equation (b) Mathematical Equation (c) Both of Them (d) None of The above B. Simulation time depends on the number of grid blocks for a given Ans.: (a) Equations (b) Properties (c) Variables (d) Simulator C. The basic steps in the formulation of all simulator equations are Ans.: (a) Darcy's law for flow through porous media (b) Continuity equation or material balance (c) Equation of State for describing the phase behavior of reservoir fluids. (d) All of Them D. Petrophysical Model determines Ans.: (a) Rock Wettability & Capillary Pressure (b) Relative Permeability & Residual Oil Saturation (c) Fluid Contacts (d) All of Them	**CO1**

	E. Simulator equations are Ans.: (a) Linear (b) Non-linear (c) Spherical (d) Radial	
Q 2	Tick the correct answer. **Each MCQ** carries **ONE** marks. A. Material Balance is a powerful tool that helps determine the Ans.: (a) Reserves (b) Recovery Factor (c) Drive Mechanism (d) All of them B. A type of formation whose rock properties are same in all directions is called Ans.: (a) Homogeneous formation (b) Isotropic formation (c) Anisotropic formation (d) None of the above C. Methods for Estimating of Vertical Sweep efficiency Ans.: (a) Stiles' Method (b) Dykstra & Parson's Method (c) Reservoir Simulation (d) None of them D. Trapped oil saturation can be minimize by Ans.: (a) Increase Capillary number (b) Decrease Capillary number (c) Increase Viscosity of oil (d) None of the above E. The Maximum water saturation at which the water phase will become immobile is Known Ans.: (a) Critical water saturation (b) Connate water saturation (c) Irreducible water saturation (d) All of the above	**CO2**

Q 3	Tick the correct answer. **Each MCQ** carries **ONE** marks. A. Flow Equations Which Include Non-Darcy Effects Ans.: (a) High Flow Rates (Inertial and Turbulent Effects) (b) Threshold and Slip Phenomena (c) Non-Newtonian Flow (d) All of Them B. Multi-phase flow is common in most petroleum reservoirs. In such multi-phase systems, we need to quantify the flow of each phase in the presence of other phases. This can be through Ans.: (a) Effective and relative permeability data (b) Effective and total porosity data (c) Effective Porosity and relative permeability data (d) All of the above C. The assumption not used in the derivation of the radial flow form of the diffusivity equation is Ans.: (a) Flow in to the wellbore continues after the well is shut in (b) Uniform thickness across the reservoir (c) A fluid with small and constant compressibility (d) Homogeneous and isotropic medium D. Differential equation mathematical language to express how things Ans.: (a) Remain constant (b) Change (c) Explain (d) Describe E. Derivation of the diffusivity equation based on Ans.: (a) Law of conservation of mass (b) Darcy's fluid flow law (c) PVT behavior of fluids (d) All of the above	**CO3**
Q 4	Tick the correct answer. **Each MCQ** carries **ONE** marks. A. Which of the following methods is used to solve for linear system equations (Finite) Ans.: (a) Explicit (b) Implicit (c) IMPES (d) All of Them	**CO4**

	B. Coordinate system used in the model are Ans.: (a) Rectangular (b) Cylindrical (c) Spherical (d) All of Them C. Iterative processes of solving simultaneous linear equations are Ans.: (a) Matrix Inversion (b) Jacobi Method (c) Gauss-Seidel Method (d) b & c D. Cartesian model geometry Ans.: (a) Suitable for all model dimensions (b) Used to accurately capture reservoir geometry (c) Used for pattern models and full field (d) a & c E. The process of distribution of the fluid saturations, pressures and establishing model in Ans.: (a) Sensitivity Analysis (b) History Matching (c) Prediction (d) Initialization	
Q 5	Tick the correct answer. **Each True/False** carries **ONE** marks. A. A good History Matching with appropriate adjustments to the data will lead to poor predictions. (True/False) B. Lower is the value of perforated interval hp the lower will be the penetration ratio and the higher the critical rate. (True/False) C. Horizontal well will have high-pressure drawdown and will exhibits minimum coning tendencies. (True/False) D. A decline curve of a well is simply a plot of the well's production rate on the y-axis n versus time on the x-axis and when the data plots concave downward, it has modelled with a "hyperbolic decline". (True/False) E. Lateral breakthrough of water from a down-dip aquifer is coning. (True/False)	**CO5**

Q 6	Tick the correct answer. **Each True/False** carries **ONE** marks. A. CMG-IMEX (Conventional "Black Oil") simulator can model the flow of water, oil, and gas, and can account for pressure-dependent solubility of gas in oil, but they cannot model changes in oil and gas composition. (True/False) B. Simulator selection depends on Types of Simulator, Phases, Geometry and Dimensionality. (True/False) C. Dual Porosity Simulators can be used for Naturally Fractured Reservoirs. (True/False) D. In Eclipse 100 Software, under SOLUTION section specifies output of initial conditions (time > 0). (True/False) E. Reservoir Simulation of highly viscous oil reservoirs can perform by using Eclipse 500 and Stars Simulator. (True/False)	**CO6**
SECTION B **1. Each question will carry 10 marks** **2. Instruction: Write short / brief notes**		
Q 1	A. Define Computer Model. What Questions Can a Computer Model Answer? **(5 Marks)** B. Define the objectives of reservoir simulation studies. Explain uses and misusage of Reservoir Simulation model. **(5 Marks)**	**CO1**
Q 2	A. Explain Assumptions, Limitations and Advantages of Material Balance Equation. **(5 Marks)** B. Explain Partial differential equation and 1 D Diffusivity Equations. **(5 Marks)**	**CO2**
Q 3	A. Explain differential form of Darcy's law for two-phase flow. Explain the forces that makes fluids move in the porous media in detail. **(5 Marks)** B. Explain upscaling. Describe different methods of upscaling. **(5 Marks)**	**CO3**
Q 4	A. Describe simulator. Explain the types and uses of each simulator. **(5 Marks)** B. Explain Pre-processor and Post Processor files for CMG Simulator. Define a box as follows: X direction - cell 1 to cell 10 Y direction - cell 1 to cell 10 Z direction - cell 1 to cell 1 (top layer only) Set the depth below sea level of the tops of each cell in the box to 9,000 feet using **BOX**, **TOPS** and **ENDBOX** keywords in Eclipse. **(5 Marks)**	**CO6**

Q 5	A. Describe model initialization during simulation. Discuss the various techniques of initialization. **(5 Marks)** B. Describe Discretization steps in the reservoir simulator development. **(5 Marks)** **OR** A. Define Decline Curve Analysis. Calculate the amount of oil predict after one year. A well has declined from 100 BOPD to 90 BOPD during a month period. Assuming Exponential decline also Calculate the rate after more 11 month. **(5 Marks)** B. Calculate the reservoir volume occupied by Released gas as well as remaining Reservoir oil volume at 850 psig. Cumulative oil production for our example Reservoir was 15.73×10^6 STB at the time when reservoir pressure was 850 psig. At the same time, cumulative production of solution gas was 3.25×10^9 SCF. **Data Given:** $N = 72.46 \times 10^6$ [STB] Rsi at 1225 psig = 230 [SCF/STB] Rs at 850 psig = 152 [SCF/STB] Bg at 850 psig = 0.002405 [RB/SCF] Bo at 850 psig = 1.244 [RB/STB] **(5 Marks)**	**CO4**
SECTION-C **1. Each Question carries 20 Marks.** **2. Instruction: Write long answer.**		
Q 1	Describe general algorithm for manual history matching along with key reservoir data and additional history matching tools. Apply the History matching Case studies of Sandstone Reservoir for any Indian or Foreign Field. **(20 Marks)** **OR** A. Explain the objectives of History Matching. Describe the overall steps used in History Matching. Describe uncertainties in History Matching. **(10 Marks)** B. Describe the various criteria for selecting the prediction cases. Describe the various Input data and output during prediction performances. Apply the Prediction Case studies of Sandstone Reservoir for any Indian or Foreign Field. **(10 Marks)**	**CO5**