



Name:  
Enrolment No:

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, July 2020**

<b>Course:</b>	<b>Enhanced Oil Recovery</b>	<b>Semester : VIII</b>
<b>Program:</b>	<b>B. Tech. APE UPSTREAM</b>	<b>Time : 03 hrs.</b>
<b>Course Code :</b>	<b>PTEG: 427</b>	<b>Max. Marks: 100</b>
<b>Nos. of page(s) :</b>	<b>5</b>	

**Instructions: All Questions are Mandatory.**  
**Section- A MCQ, T/F and Fill in the Blanks.**  
**Section- B Answers required in few sentences without diagram. 4 questions are compulsory 1 question has internal choice**  
**Section- C 1 Question compulsory with internal choice. Descriptive without diagram.**

**SECTION A** **Marks 5\*6 = 30**

Sl. No.	Statement of question	Marks	CO
Q 1	<p><u>Tick the correct answer. Each MCQ carries ONE marks.</u></p> <p>(a) <b>Application of engineering techniques to produce more oil after primary production is known as</b>            Ans.:            (a) Improved oil recovery            (b) Ultimate oil recovery            (c) Primary recovery            (d) Estimated recovery</p> <p>(b) <b>ONGC has accepted the classifications for Reserve is</b>            Ans.            (a) USSR            (b) SPE            (c) WPC            (d) None of the above</p> <p>(c) <b>What is the name for reserves that are calculated based on tests that the oil can be produced with 10 % certainty?</b>            Ans.:            (a) Proven            (b) Probable            (c) Possible            (d) None of the above</p>	5	CO1

	<p>(d) <b>The Recovery factor is</b>          Ans.:          (a) A ratio of the OOIP to the amount of oil in the reservoir at the economic limit          (b) A ratio of the OOIP to the amount of gas in the reservoir at the economic limit Possible          (c) A ratio of the OOIP to the amount of total reserves in the reservoir at the economic limit Possible          (d) None of the above</p> <p>(e) <b>Which of the following curves determines the economic limit for a well?</b>          Ans.:          (a) Decline curve          (b) Saturation curve          (c) Permeability curve          (d) None of the above</p>		
Q 2	<p><u>Tick the correct answer. Each MCQ carries ONE marks.</u></p> <p>(a) <b>Most widely used post-primary recovery is</b>          Ans.:          (a) Water flooding          (b) Polymer flooding          (c) Steam flooding          (d) None of them</p> <p>(b) <b>Methods for Estimating of Vertical Sweep efficiency</b>          Ans.:          (a) Stiles' Method          (b) Dykstra &amp; Parson's Method          (c) Reservoir Simulation          (d) None of them</p> <p>(c) <b>What type of reservoir drive maintains a constant reservoir pressure most of the production life?</b>          Ans.:          (a) Water drive          (b) Depletion drive.          (c) Gas cap drive          (d) None of the above</p> <p>(d) <b>Micellar polymer is also known as</b>          Ans.:          (a) Micro emulsion flooding          (b) Low tension flooding          (c) Chemical flooding          (d) All of the above</p> <p>(e) <b>The viscosity of polymer solution as a non-Newtonian fluid measured at particular shear rate is known as</b>          Ans.:          (a) Relative Viscosity          (b) Dynamic viscosity</p>	5	CO2

	(c) Apparent viscosity (d) Kinematic Viscosity		
Q 3	<p><u>Tick the correct answer. Each True/False carries ONE marks.</u></p> <p>(a) In a homogeneous reservoir, maximum oil recovery can be expected if flooding is initiated when the bubble point pressure is not reached. (True/False)</p> <p>(b) In faulted &amp; fissured reservoirs, &amp; those with high permeability streaks, channeling allows the displacing fluid to bypass some of the oil in place &amp; leads to a high recovery factor. (True/False)</p> <p>(c) Reservoir depth has an important influence on both the technical &amp; economic aspects of an enhanced recovery project. (True/False)</p> <p>(d) In Water Flooding poor compatibility between injected water and reservoir may cause formation damage. (True/False)</p> <p>(e) Material Balance equation first presented by Schilthuis in 1946. (True/False)</p>	5	CO1
Q 4	<p><u>Tick the correct answer. Each True/False carries ONE marks.</u></p> <p>(a) The Gravity Segregation mechanism occurs in layers especially in a thick reservoir with good to excellent horizontal permeability. (True/False)</p> <p>(b) Horizontal well will have low pressure drawdown and will exhibits minimum coning tendencies. (True/False)</p> <p>(c) To achieve an ideal viscosity polymer requirement 5 to 10 times higher compared to sea water (True/False)</p> <p>(d) The water quality parameters which affect polymer viscosity and stability are Salinity, hardness, Dissolved iron, Dissolved oxygen and Bacterial activity (True/False)</p> <p>(e) Synthetic Polymer (HPAM) can be used up to 120 degree C using its Copolymer with AMPS and NVP. (True/False)</p>	5	CO2
Q 5	<p><u>Fill the correct answer. Each Fill in the Blanks carries ONE marks.</u></p> <p>(a) In Peripheral Injection Patterns, the injection wells are located at the _____ of the reservoir and the oil is displaced toward the interior of the reservoir.</p> <p>(b) Central Line Drive pattern is applicable when reservoir is _____.</p> <p>(c) The wells are arranged in an _____ pattern which has one Injector and four Producers.</p> <p>(d) High Pressure Air Injection (HPAI) Can be applied in tight reservoirs where Water injectivity is _____.</p> <p>(e) A more efficient method for employing gas injection can sometimes used in reservoirs which have good _____ and are either thick, or steeply dipping.</p>	5	CO3

Q 6	<p>Fill the correct answer. <b>Each Fill in the Blanks</b> carries <b>ONE</b> marks.</p> <p>(a) In _____ both injection and production wells are injected with superheated steam.</p> <p>(b) Gas based EOR process should be selected when Crude oil gravity should be more than _____.</p> <p>(c) In Toe To Heel Air Injection (THAI) Method highest recovery is up to _____.</p> <p>(d) Nitrogen flooding is generally substitute of CO2 for _____.</p> <p>(e) CO2 flood process can be applied to wider range of reservoir because of its lower _____ than that for vapourizing gas drive.</p>	5	CO3
<b>SECTION B</b>		<b>Marks 10*5 = 50</b>	
Q 1	<p>(a) Define the difference in IOR and EOR. Write down the selecting criteria of different types of EOR methods. <b>(5 Marks)</b></p> <p>(b) Define Drive Mechanism. Explain different types of Drive Mechanism. <b>(5 Marks)</b></p>	10	CO1
Q 2	<p>(a) Define Coning. Write down the name of correlations used for Water Coning and Gas Coning and for combined Water and Gas coning. <b>(5 Marks)</b></p> <p>(b) Define Water Flooding Process. Explain the different factors effecting the Water Flooding Process? Describe advantages of Water Flooding Process. <b>(5 Marks)</b></p>	10	CO2
Q 3	<p>(a) Explain Polymer flooding method. Define the applications of Polymer. Describe selection criteria for EOR Polymer Flooding method. <b>(5 Marks)</b></p> <p>(b) Write down the parameters on which viscosity of polymer solution depends. Explain types of polymers for EOR applications. <b>(5 Marks)</b></p>	10	CO2
Q 4	<p>(a) Define Microbial Method. Define the types of microbes cultured in laboratory. Describe Huff and Puff Microbial Method. <b>(5 Marks)</b></p> <p>(b) Define advances in EOR. Explain CHOPS (Cold Heavy Oil Production with Sand) and Vapor (VAPEX) methods. <b>(5 Marks)</b></p>	10	CO4
Q 5	<p>(a) Describe the criteria of simulator selection. Write down the name of Commercial simulators for different EOR recovery processes. Write down Pre Processor and Post Processor files For CMG. <b>(5 Marks)</b></p> <p>(b) Explain classical and Geocellular Modelling. Write down the name of Software for Seismic to Simulation study. Describe the major element of Reservoir Simulation study of an EOR method. <b>(5 Marks)</b></p>	10	CO6

	<p style="text-align: center;"><b>OR</b></p> <p>Define the eclipse options. Write down the different keywords (in detail) used in Eclipse for RUNSPEC, GRID, EDIT, PROPS, REGIONS, SOLUTIONS, SUMMARY, and SHEDULE Sections for dynamic simulation. Defining values one cell at a time and set 10 cells to have length of 500 feet using <b>DX</b> Keyword. <span style="float: right;"><b>(10 Marks)</b></span></p>																		
<b>SECTION C</b>		<b>Marks 20*1 = 20</b>																	
Q 1	<p>(a) Define Thermal EOR method. Explain different Steam flood process. Describe applications and limitation of Steam Flood process with case study of successful implementation in any Indian Oil Field. <span style="float: right;"><b>(10 Marks)</b></span></p> <p>(b) A Combustion test in confined pattern was conducted on a depleted oil reservoir with current oil recovery of 12 percent. Estimate the final oil recovery expected after the commercial development of the in situ combustion method given the following:</p> <table style="margin-left: 40px; border: none;"> <tr> <td>Confined acre</td> <td style="text-align: right;">1.29 acres</td> </tr> <tr> <td>Net thickness</td> <td style="text-align: right;">25 ft</td> </tr> <tr> <td>Effective porosity</td> <td style="text-align: right;">28%</td> </tr> <tr> <td>Irreducible water saturation</td> <td style="text-align: right;">24%</td> </tr> <tr> <td>Oil formation volume factor</td> <td></td> </tr> <tr> <td>Initial</td> <td style="text-align: right;">1.20</td> </tr> <tr> <td>Current</td> <td style="text-align: right;">1.12</td> </tr> <tr> <td>Cumulative oil production of the central Well P, as the effect of combustion</td> <td style="text-align: right;"><math>\Delta N_c = 11.845 \text{ bbl}</math></td> </tr> </table> <p style="text-align: right;"><b>(10 Marks)</b></p> <p style="text-align: center;"><b>OR</b></p> <p>(a) Describe different types of Miscible Recovery Method? Explain most suitable N<sub>2</sub> Flooding Method for deep reservoirs with case study of any Indian or Foreign Oil Field. <span style="float: right;"><b>(10 Marks)</b></span></p> <p>(b) Describe CO<sub>2</sub> Flooding method and its limitations. Explain CO<sub>2</sub> Flooding Mechanism. Describe Case study of CO<sub>2</sub> flooding Method with case study of any Indian or Foreign Oil Field. <span style="float: right;"><b>(10 Marks)</b></span></p>	Confined acre	1.29 acres	Net thickness	25 ft	Effective porosity	28%	Irreducible water saturation	24%	Oil formation volume factor		Initial	1.20	Current	1.12	Cumulative oil production of the central Well P, as the effect of combustion	$\Delta N_c = 11.845 \text{ bbl}$	<b>20</b>	<b>CO5</b>
Confined acre	1.29 acres																		
Net thickness	25 ft																		
Effective porosity	28%																		
Irreducible water saturation	24%																		
Oil formation volume factor																			
Initial	1.20																		
Current	1.12																		
Cumulative oil production of the central Well P, as the effect of combustion	$\Delta N_c = 11.845 \text{ bbl}$																		