

Name:  
Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**Online End Semester Examination, May 2021**

**Course: PEAU 3019 Advanced Production Engineering**  
**Program: APE VI(Upstream)**  
**Time: 03 hrs.**

**Semester: VI**  
**Max. Marks: 100**

**Instructions:**

This question paper has three sections, Section A,B and C  
There are total of 30 questions of 1 mark each in section A, There is a case study in section B and there are 10 questions of 5 marks each in Section B. In Section C there is 1 question with sub parts of ten marks each.  
Section A consist of short answers  
Section B consist of medium length answers.(Case study)  
Section C consists of one question (a case study).  
The maximum time allocated is three Hrs.  
The question paper should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, SAP-id at the top and signature at the bottom (right hand side bottom corner). Black pen should be used for better visibility and quality of scan.  
Please check the scan quality before uploading the scan.  
Assume any missing data

**SECTION A**

**30 Marks (6x5)**

**Read questions carefully and give precise answers.**

**All questions are compulsory**

**Q. 1 CO 1**

- What is the reason for re-entrainment?
- What is  $L_{eff}$  in separator design?
- $V_t$  is terminal velocity. It represented as  $V_t = \dots\dots\dots$  for laminar flow.
- What is the value of corrosion allowance for corrosive service in oil and gas separator?
- What is importance of slenderness ratio?

**Q.2 CO 2**

- Name at least three emulsifying agents are present in reservoir fluids/rocks
- Oil and water separation in demulsification is governed by which law?
- As per API 11L, what should be the viscosity of heated crude for demulsification and desalting?
- What is oil shrinkage in oil processing?
- Give one two disadvantages of DC type electrostatic treater.

**Q.3 CO 3**

- a. What should be the repeatability of a custody transfer meter?
- b. What is the working principle of an Ultrasonic meter?
- c. Define meter factor of a meter.
- d. Name a bi-directional meter.
- e. Write full form of LACT

**Q.4 CO 4**

- a. Name three types of oil storage tanks used in oil industry.
- b. Name two materials used for saving oil storage tanks to save them from corrosion in side of the tank.
- c. What is the purpose of breathing valve in a storage tank?
- d. What is the difference in breathing valve and safety valve in a storage tank?
- e. Write code number for designing over ground field welded soil storage tank.

**Q.5 CO 5**

- a. Which code is used for offshore pipe lines and liquid transportation system?
- b. What is 't<sub>th</sub>' in pipeline design equation?
- c. Write four typical steps for laying an onshore pipeline.
- d. What is the function of intelligent pig?
- e. What is static lift and dynamic head for a pump?

**Q.6 CO 6**

- a. Polytropic efficiency is given by  $\eta_p =$
- b. What is the function of diffuser in a centrifugal compressor?
- c. What is clearance volume in a positive displacement compressors?
- d. Generally there are three conditions to cause galvanic corrosion. Write any two.
- e. What is the mechanism involved in CO<sub>2</sub> corrosion

<b>SECTION B</b>		<b>50 MARKS ( 5*10)</b>
<b>All questions are compulsory</b>		
<p>It is decided to develop an offshore field by drilling 80 wells. These wells will be drilled from 5 different platforms. These platforms are at distance of five kilometers from the proposed process platform. So infield well flow and gas lift pipelines shall be required. The field is expected to produce 75000 barrels of oil at peak and a maximum of 42 MMSCFD of gas. Crude oil is waxy with some asphaltene. Oil specific gravity is 35 API and pour point is 42degrees Celsius. The reservoir is saturated with partial support from aquifer. Development plan envisages water injection for pressure maintenance for improved recovery. Water injection will start along with start of oil production. As reservoir is partially supported with</p>		

<p>aquifer and water injection, field is expected to produce water. Peak water content shall be 90%. The emulsion of the field was tested and it was found to be quite a tough and difficult to break merely by heating. Initially the field shall be produced on self-flow mode but will need artificial lift in later life. During initial testing of wells, it has been found that gas lift is the preferred mode of artificial lift. The field is located at a place where ambient temperature range is 9 degrees Celsius as minimum temperature and 45 degrees Celsius and maximum temperature. Temperature at sea bed is 3 degrees Celsius.</p>		
<p>As the field is under water injection, it is expected the field may produce H<sub>2</sub>S in the later stages. Presently the produced gas contains about 2% CO<sub>2</sub>. Though the water treatment system (Design of water injection system is not included in your scope of work) is quite efficient but H<sub>2</sub>S production cannot be ruled out fully. It is expected that 25 to 30 ppm. of H<sub>2</sub>S may be produced.</p>		
<p>First oil and gas shall be processed at offshore process plant before its evacuation to onshore terminal. For evacuation of oil and gas, pipelines will laid to onshore oil processing terminal. All efforts are being made to complete oil and gas evacuation lines, but it is expected that there could be some delay in completion of these evacuation lines. Till the time oil evacuation line is ready, the produced oil shall be loaded in tanker and shall be shipped to onshore by ferry tankers. Produced gas shall be injected into a depleted oil reservoir which is nearby this field. Gas injection pressure is expected to be 1800 psig.</p>		
<p>You have been hired as an engineering consultant. You have been asked to complete following tasks:</p>		
<p><b>Q.1</b></p>		
<p><b>a.</b> Propose an oil processing scheme (with diagram) for offshore tanker loading and pipeline pumping. Ignore single point mooring system.</p>	<p><b>CO 1</b></p>	
<p><b>b.</b> Design parameters for design of oil and gas separator. Assume missing data.</p>	<p><b>CO 1</b></p>	
<p><b>Q.2</b></p>		
<p><b>a.</b> Instead of three phase separator for water separation, a heater treater is proposed to be used. For heating emulsion, thermic fluid and a heat exchanger shall be used. Propose design parameters for designing the heater treater. Assume missing data.</p>	<p><b>CO 2</b></p>	
<p><b>b.</b> Propose instrumentation required for oil and gas separator and heater treater. Give a sketch</p>	<p><b>CO 2</b></p>	
<p><b>Q.3</b></p>		
<p><b>a.</b> Draw a sketch for gas transportation system for gas pipeline. Assume (a) gas has been processed for pipeline transportation (b) A centrifugal compressor is being used.</p>	<p><b>CO 5</b></p>	
<p><b>b.</b> What are design considerations for installation of a centrifugal pump</p>	<p><b>CO 5</b></p>	

