Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 20- 05-2026 **Time:**01:00pm – 04:00pm

School: SOE	**Program:** B. Tech-PET	
Course Code: PET2023	**Course Name:** Design in Production Engineering	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	5	5	5	29	28	28

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Identify the main components of a heater treater.	**2 Marks**	**L1**	**CO4**
2.	Recognize two common emulsion-treating mechanisms inside a heater treater.	**2 Marks**	**L1**	**CO4**
3.	Compute the heat input when oil is heated from 20°C to 90°C.	**2 Marks**	**L2**	**CO5**
4.	Differentiate between latent heat and sensible heat.	**2 Marks**	**L2**	**CO5**
5.	Describe how density difference is related to settling velocity using Stokes' law.	**2 Marks**	**L2**	**CO5**
6.	Predict what will happen to settling velocity if droplet size is very small.	**2 Marks**	**L2**	**CO5**
7.	Classify the types of heat exchangers based on construction.	**2 Marks**	**L2**	**CO6**
8.	Define any two parts of a shell and tube heat exchanger.	**2 Marks**	**L1**	**CO6**
9.	Describe the fouling phenomenon in heat exchangers.	**2 Marks**	**L2**	**CO6**
10.	Describe the law governing conduction mode of heat transfer.	**2 Marks**	**L2**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	(i) Describe how charge size and formation properties affect the performance of perforation in oil wells, with a suitable diagram. (ii) Describe the configuration of a gas lift system considering different valve arrangements and production flow conditions.	**5+5 Marks**	**L2**	**CO1, CO2**
	b.	(i) A vertical well of depth 2800 m has a tubing head pressure of 850 kPa and casing head pressure of 3900 kPa. The tubing gradient is 11 kPa/m and gas gradient is 4.5 kPa/m. If 4 unloading valves are installed, Using the constant pressure drop method, determine the depth at which each valve should be placed. (ii) Determine the operating conditions that control the separation of emulsions in a heater treater.	**5+5 Marks**	**L3**	**CO3, CO4**
		Or			
12.	**a.**	(i) **Classify** the perforation methods used in well completion and mention the advantages of jet perforation. (ii)Expain the surface and subsurface equipments of Gas lift.	**5+5 Marks**	**L2**	**CO1, CO2**
	b.	(i) A marginal well is to be operated using intermittent gas lift based on the fallback approach. Given data: Tubing inside diameter = 2.25 in, Average liquid fallback velocity = 0.7 m/s, Injection gas pressure = 5200 kPa, Tubing pressure gradient = 12 kPa/m, Valve opening pressure differential = 400 kPa. Apply the fallback method to determine the depth of the unloading valve. (ii) Determine the different methods employed for emulsion separation in heater treaters and explain their basic principles.	**5+5 Marks**	**L3**	**CO3, CO4**

13.	**a.**	Determine the equation governing particle settling in a fluid using Stoke's law and explain its application in crude oil demulsification.	**10 Marks**	**L3**	**CO4**
	b.	Determine the key variables that control gravity separation processes and explain the influence of temperature on phase separation performance.	**10 Marks**	**L3**	**CO4**
		Or			
14.	**a.**	Examine the important parameters influencing the performance and sizing of gravity-based separation systems in petroleum processing.	**10 Marks**	**L3**	**CO4**
	b.	Determine how a heater treater facilitates phase separation by gravity and illustrate the process with a clear diagram.	**10 Marks**	**L3**	**CO4**

15.	Determine the capacity of a heater treater vessel required to achieve proper gravity separation under the following conditions: Droplet size = 120 μm, Viscosity (μ) = 0.025 Pa·s, Density difference ($\Delta\rho$) = 180 kg/m^3, Height = 2.0 m, Flow rate = 220 m^3/day. Further, what will happen to the settling velocity when the droplet size is reduced by 50% from its initial value.	**20 Marks**	**L3**	**CO5**
	Or			

16.	5 Kg of ice sample initially at -5^{o}C is heated to stem at 120 ^{o}C use the data given below to determine the total heat required. C_{ice} = 2 KJ/Kg.^{o}C, h_f =300KJ/Kg, C_{water} =4.18 KJ/Kg.^{o}C, h_{fg} =2000KJ/Kg, C_{stem}= 2KJ/Kg. Show each stage of heat addition clearly. Further, distinguish between latent heat of vaporization and specific heat capacity.	**20 Marks**	**L3**	**CO5**

17.	Breakdown the methodology followed in the thermal design of a shell-and-tube heat exchanger and analyze the impact of factors like heat duty estimation, log mean temperature difference, fouling considerations, and heat transfer coefficient on the overall design in surface production operations.	**20 Marks**	**L3**	**CO6**
	Or			
18.	Examine how changes in hydrocarbon characteristics like viscosity, heat capacity, and density affect heat exchanger performance, and evaluate their implications on exchanger dimensions, number of tube passes, and overall heat transfer requirements.	**20 Marks**	**L3**	**CO6**