Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - DEC 2022

Semester : Semester III - 2021
Course Code : PET2009
Course Name : Sem III - PET2009 - Thermodynamics of Reservoir Fluids
Program : B.Tech. Petroleum Engineering

Date : 13-JAN-2023
Time : 1.00PM - 4.00PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE TEN QUESTIONS **10 X 2 = 20M**

1. Define thermodynamic system.

(CO1) [Knowledge]

2. State first law of thermodynamics and its mathematical expression.

(CO1) [Knowledge]

3. What is thermal efficiency of heat engine?

(CO1) [Knowledge]

4. State Clausius' statement.

(CO1) [Knowledge]

5. Define triple point.

(CO1) [Knowledge]

6. State Gibbs phase rule.

(CO1) [Knowledge]

7. Define Gibbs energy.

(CO1) [Knowledge]

8. Describe throttling process.

(CO2) [Knowledge]

9. Discuss the properties of ordinary black oil.

(CO3) [Knowledge]

10. Define formation volume factor.

(CO3) [Knowledge]

PART B

ANSWER ALL THE FOUR QUESTIONS **4 X 10 = 40M**

11. “The efficiency of heat engine is always less than unity". Give a mathematical proof of this statement and relate it with second law of thermodynamics.

(CO1) [Comprehension]

12. “A certain property of the system remains constant during phase transition”, Identify the property and mathematically prove the above statement.

(CO1) [Comprehension]

13. With the help of neat and labeled diagram, state the common classifications of crude oils and state the salient features of these crude oil.

(CO3) [Comprehension]

14. A certain process follows the relationship PV = constant. Identify the process and obtain the relationship for work, heat and internal energy.

(CO1) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS **2 X 20 = 40M**

15. (a) "A turbine is an essential device used in power plants which assists in generation of electricity. It contains elements that rotate. This rotation is transferred to generator which generates the electricity". In one such turbine steam enters at 350ºC and 2 MPa. The exit from the turbine is a saturated vapor at 50 kPa. Determine the efficiency of the turbine (*Use the provided Mollier Diagram and attach with answer script*).
(b) Describe the process termed as PT flash. List the places where a crude oil might experience PT flash.

(CO2) [Application]

16. (a) A solution contains 78.0 gram of glucose (MM = 180.16 g/mol) in 500 grams of water at 25ºC. The vapor pressure of pure water at this temperature is 23.8 mm Hg.
Based on the data given above:

- (i) Identify and state the theory/law which you can would apply to determine the vapor pressure of the solution.
- (ii) Based on the identified theory/law estimate the vapor pressure of the solution based on the data given above. (*Assume MM of water to be 18.02 g/mol*)

(b) Calculate Degree of freedom for :

- (i) Liquid water in equilibrium with its vapor.
- (ii) Liquid water in equilibrium with a mixture of water vapor and nitrogen.
- (iii) A three-phase system of a saturated aqueous salt solution at its boiling point with excess salt crystals present.

(CO1) [Application]

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