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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER / NOVEMBER—2023

DPET – FIFTH SEMESTER EXAMINATION

THERMODYNAMICS AND REACTION ENGINEERING

Time : 3 Hours] [*Total Marks* : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Distinguish between state function and path function.

2. What are the limitations of first law of thermodynamics?

3. Define heat capacity and how it is classified.

4. Give the schematic representation of heat engine and heat pump.

5. What is refrigerant? How they are classified?

6. Write the characteristics of chemical equilibrium.

7. State the variables affecting the rate of reactions.

8. Define *(a)* molecularity and *(b)* order of reaction.

9. List out the methods of determine order of reaction.

10. What is catalyst poisoning ? Give an example.

PART—B

8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Derive the expression for first law of thermodynamics as applied to steady state flow processes. State the assumptions.

(OR)

(b) Air is compresses from 2 atm absolute and 28°C to 6 atm absolute and 28°C by heating at constant volume followed by cooling at constant pressure. Calculate the heat and work requirements and change in internal energy of the air. Data $C_v = 0{\cdot}718\,\text{kJ/kg-°C}$ and $C_p = 1{\cdot}005\,\text{kJ/kg-°C}$ respectively.

12. *(a)* Verify that the reversible engine always has higher efficiency than the irreversible engine, if both are operating between the same temperature levels.

(OR)

(b) Calculate the entropy change that results from mixing 54 grams of water at 280 K with 27 grams of water at 360 K in a vessel whose walls are perfectly insulated from the surroundings. The heat capacity of liquid water is assumed to be constant over the temperature range from 280 K to 360 K (heat capacity of water = 4·18 J/g-K).

13. *(a)* What is liquefaction? Explain the process of liquefaction by Linde process.

(OR)

(b) With a sketch, explain the method of obtaining vapor absorption refrigeration.

14. *(a)* What is Le Chatelier's principle. Explain Le Chatelier's principle for Haber's process.

(OR)

(b) Derive the relation between standard Gibb's free energy and equilibrium constant.

15. *(a)* Explain the working principle of fixed bed reactor with the help of a sketch.

(OR)

(b) Write the characteristics of catalytic reactions.

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. Derive the design equation for plug flow reactor.

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