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C20-CH-PET–405

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2023

DCHE – FOURTH SEMESTER EXAMINATION

HEAT TRANSFER

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. What are the three modes of heat transfer?

2. Define countercurrent and concurrent flows in a heat exchanger.

3. Explain briefly about Nusselt number.

4. Write the relation between individual and overall heat transfer coefficients.

5. Explain briefly the regimes of heat transfer in fluids.

6. Explain briefly Stefan-Boltzmann's law of radiation.

7. What is Wien's displacement law?

8. List out the parts of a shell and tube heat exchanger.

9. Write brief notes on contact condensers.

10. Discuss briefly the function of ejectors in an evaporator system.

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)* A furnace is constructed with 20 cm of silica brick, 10 cm of insulating brick and 12.5 cm of building brick. The temperature of the inner surface of the wall is 975 °C and that at outer surface is 70 °C. Find the heat loss per unit area and the temperature at the interfaces between different kinds of bricks.

Data :

Thermal conductivity of silica brick	=	1.75 W/m°K
Thermal conductivity of insulating brick	=	0.124 W/m°K
Thermal conductivity of building brick	=	0.744 W/m°K

(OR)

(b) Derive an equation to evaluate heat transfer rate by conduction through rectangular composite wall.

12. *(a)* Derive the relationship between individual and overall heat transfer coefficients.

(OR)

(b) Air is heated in an air heater from 293 K to 373 K by hot gases. The hot gases thus cool from 473 K to 418 K. Calculate LMTD for *(i)* parallel flow and *(ii)* counterflow.

13. *(a)* 30 kg/hr of water is to be heated from 30 °C to 45 °C while flowing through a horizontal 2 cm diameter steel pipe. If the pipe is jacketed with steam condensing at 100 °C, what length of pipe is required if the flow rate is found to be laminar?

Data :

K = 0.63 W/m°K

μ_{100} = 0.682 cp

μ_{av} = 1.683 cp

(OR)

(b) Explain about thermal boundary layer. How is it related to hydrodynamic boundary layer?

14. *(a)* Describe the working and construction of a floating head heat exchanger with a neat diagram.

(OR)

(b) Draw neat line sketches of 1-2 and 2-4 shell and tube heat exchangers and also draw the temperature versus length profiles in each case.

15. *(a)* Describe with neat sketch the construction and working of an agitated film evaporator and mention its advantages.

(OR)

(b) State Dühring's rule and explain Dühring's plots and their applications.

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. Explain the various methods of feeding the multiple effect evaporator with neat line diagrams and write its merits and demerits.

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