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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING**

**MID TERM EXAMINATION**

**Winter Semester:** 2021- 22

**Course Code:** PET 2008

**Course Name:** Fundamentals of Transport Phenomenon

**Program & Sem:** B. Tech (PET) & II Sem

**Date:** 14/MAY/2022

**Time:** 01:30PM-03:00PM

**Max Marks:** 50

**Weightage:** 25%

**Instructions:**

- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consist of three parts, PART A, B & C
- (iii) All questions are mandatory

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(5Qx 2M= 10M)**

1. When we are heating the tip of a metal rod, which direction will the heat flow and why?  
(C.O.No.1) [Application]
2. What do you understand by Biot number? (C.O.No.1) [Application]
3. Explain what you understand by Natural Convection. (C.O.No.1) [Application]
4. Which law governs conduction? State it and explain? (C.O.No.1) [Application]
5. Suppose three identical shape solid body of different material is given to you. You can find out any property of the body. How will you find out the body in which the rate of heat flow will be highest?  
(C.O.No.1) [Application]

**Part B [Thought Provoking Questions]**

**Answer the Questions. Question carries EIGHT mark.**

**(2Qx8M=16M)**

6. What are fins? Elaborate why and when do we use them? What are the different types of fins? Which fins would you use for the following scenario?
  - a) For a square slab
  - b) In a cylindrical pipe flowing a fluid
  - c) In a microprocessor used in PC

How can you find the Fin efficiency and Fin Effectiveness?

(C.O.No.1) [Application]

7. Find out the rate of heat flow  $Q$  when we are boiling a chemical liquid. The Thermal Conductivity of the chemical liquid is given  $3.75 \text{ W/mK}$  and the heat transfer coefficient of the chemical liquid is  $7.5 \text{ W/m}^2\text{K}$  the length is  $12 \text{ m}$  and the area is  $12.5 \text{ m}^2$ . The hot surface temperature is  $140 \text{ K}$  and cold surface temperature is  $80 \text{ K}$ . Explain the different ways by which conduction can take place. What is  $K$  in Fourier's law, explain it?

[8M] (C.O.No.1) [Application]

### Part C [Problem Solving Questions]

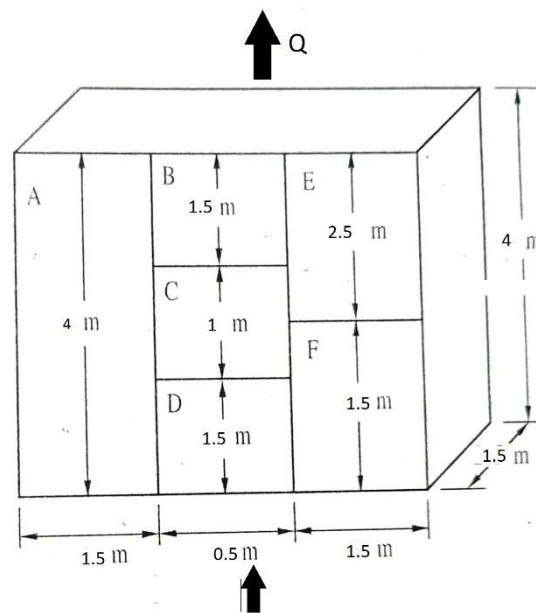
Answer the Questions. Question carries TWELVE mark.

(2Qx12M=24M)

8 A composite wall is shown in the figure. Calculate the rate of heat flow by conduction.

$K_A=15.3$ ,  $K_B=4.5$ ,  $K_C=3.1$ ,  $K_D=1.9$ ,  $K_E=3.6$ ,  $K_F=1.6$ ,  $H_i=7500$ ,  $H_o=3000$ ,  $T_i=950 \text{ K}$ ,  $T_o=120 \text{ K}$ .

(C.O.No.1) [Application]



9 A furnace wall consists of 45 cm of layer 1, 35 cm of layer 2 and a 25cm layer 3 on the outside. If the inside surface temperature of the furnace is  $1900 \text{ K}$  and outside surface temperature is to be  $220 \text{ K}$ . Calculate the temperatures between the layers and the heat flow by conduction of furnace wall. Take  $K$  for layer 1 =  $3.28 \text{ W/m-k}$ ,  $k$  for layer 2 =  $45.37 \text{ W/m-k}$ ,  $k$  for layer 3 =  $2.44 \text{ W/m-k}$ ,  $H_i=5000$ ,  $H_o=3000$ .

(C.O.No.1) [Application]



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**Max Marks:** 50

**Weightage:** 25%

**Instructions:**

- (i) *Read the all questions carefully and answer accordingly.*
- (ii) *Question paper consist of three parts, PART A, B & C*
- (iii) *All questions are mandatory*

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(5Qx 2M= 10M)**

1. When we are heating the tip of a metal rod, which direction will the heat flow and why?  
(C.O.No.1) [Application]
2. What do you understand by Biot number?  
(C.O.No.1) [Application]
3. Explain what you understand by Natural Convection.  
(C.O.No.1) [Application]
4. Which law governs conduction? State it and explain?  
(C.O.No.1) [Application]
5. Suppose three identical shape solid body of different material is given to you. You can find out any property of the body. How will you find out the body in which the rate of heat flow will be highest?  
(C.O.No.1) [Application]

**Part B [Thought Provoking Questions]**

**Answer the Questions. Question carries EIGHT mark.**

**(2Qx8M=16M)**

6. What are fins? Elaborate why and when do we use them? What are the different types of fins? Which fins would you use for the following scenario?
- a) For a square slab
  - b) In a cylindrical pipe flowing a fluid
  - c) In a microprocessor used in PC
- How can you find the Fin efficiency and Fin Effectiveness?  
(C.O.No.1) [Application]

7. Find out the rate of heat flow  $Q$  when we are boiling a chemical liquid. The Thermal Conductivity of the chemical liquid is given  $3.75 \text{ W/mK}$  and the heat transfer coefficient of the chemical liquid is  $7.5 \text{ W/m}^2\text{K}$  the length is  $12 \text{ m}$  and the area is  $12.5 \text{ m}^2$ . The hot surface temperature is  $140 \text{ K}$  and cold surface temperature is  $80 \text{ K}$ . Explain the different ways by which conduction can take place. What is  $K$  in Fourier's law, explain it?

[8M] (C.O.No.1) [Application]

### Part C [Problem Solving Questions]

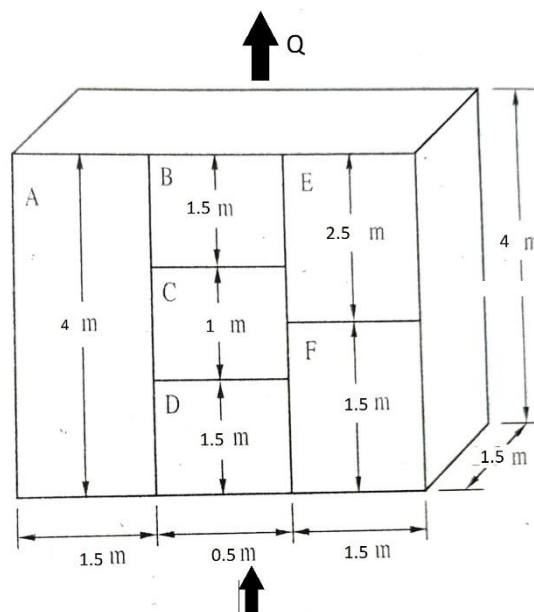
Answer the Questions. Question carries TWELVE mark.

(2Qx12M=24M)

8 A composite wall is shown in the figure. Calculate the rate of heat flow by conduction.

$K_A=15.3$ ,  $K_B=4.5$ ,  $K_C=3.1$ ,  $K_D=1.9$ ,  $K_E=3.6$ ,  $K_F=1.6$ ,  $H_i=7500$ ,  $H_o=3000$ ,  $T_i=950 \text{ K}$ ,  $T_o=120 \text{ K}$ .

(C.O.No.1) [Application]



9 A furnace wall consists of 45 cm of layer 1, 35 cm of layer 2 and a 25cm layer 3 on the outside. If the inside surface temperature of the furnace is  $1900 \text{ K}$  and outside surface temperature is to be  $220 \text{ K}$ . Calculate the temperatures between the layers and the heat flow by conduction of furnace wall. Take  $K$  for layer 1 =  $3.28 \text{ W/m-k}$ ,  $k$  for layer 2 =  $45.37 \text{ W/m-k}$ ,  $k$  for layer 3 =  $2.44 \text{ W/m-k}$ ,  $H_i=5000$ ,  $H_o=3000$ .

(C.O.No.1) [Application]



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BENGALURU**

**SCHOOL OF ENGINEERING**

**END TERM EXAMINATION**

**Winter Semester:** 2021- 22

**Course Code:** PET 2008

**Course Name:** Fundamentals of Transport Phenomenon

**Program & Sem:** B. Tech (PET) & II Sem

**Date:** 29 /JUNE/2022

**Time:** 1:00PM-4:00PM

**Max Marks:** 100

**Weightage:** 50%

**Instructions:**

- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consist of three parts, PART A, B & C
- (iii) All questions are mandatory

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(9Qx 2M= 18M)**

- Q.NO.1. List the different types of Convection. [2M] (C.O.No.1) [Knowledge]
- Q.NO.2. What do you understand by Thermal conductivity? [2M] (C.O.No.2) [Knowledge]
- Q.NO.3. Consider the saturation temperature of the air to be 30 ° C, and the surface temperature of a wall to be 32 ° C. Will Condensation take place? Give reasons for your answer. [2M] (C.O.No.2) [Knowledge]
- Q.NO.4. Define Stefan Boltzman Law. [2M] (C.O.No.3) [Knowledge]
- Q.NO.5. What do you understand by Fourier Number? [2M] (C.O.No.2) [Knowledge]
- Q.NO.6. In Pool Boiling, which stage the heat transfer through conduction take place? [2M] (C.O.No.3) [Knowledge]
- Q.NO.7. What do you mean by reflectivity in radiation? [2M] (C.O.No.2) [Knowledge]
- Q.NO.8. What is the difference between convection and radiation? [2M] (C.O.No.2) [Knowledge]
- Q.NO.9. Which law governs conduction? State it and explain? [2M] (C.O.No.1) [Knowledge]

**Part B [Thought Provoking Questions]**

**Answer the Questions. Question carries EIGHT marks.**

**(5Qx8M= 40M)**

- Q.NO.10. What do understand by convection? Which law does convection follow, explain? Also explain the different types of convection with an example. [8M] (C.O.No.1) [Application]
- Q.NO.11. Suppose a rectangular solid body of size 8m x 3m is given to you. Explain all the different possibilities by which you can increase the rate of heat transfer. Out of all the possibilities you have given select the possibility which is practical and can be applied in real life. Explain the concept in detail. [8M] (C.O.No.1) [Application]

Q.NO.12. What are the conditions for condensation to occur in a surface. Explain the type of condensation in which the rate of heat transfer is high? [8M] (C.O.No.2) [Application]

Q.NO.13. What do you understand by emissivity? Explain all the laws of radiation in detail. [8M] (C.O.No.3) [Application]

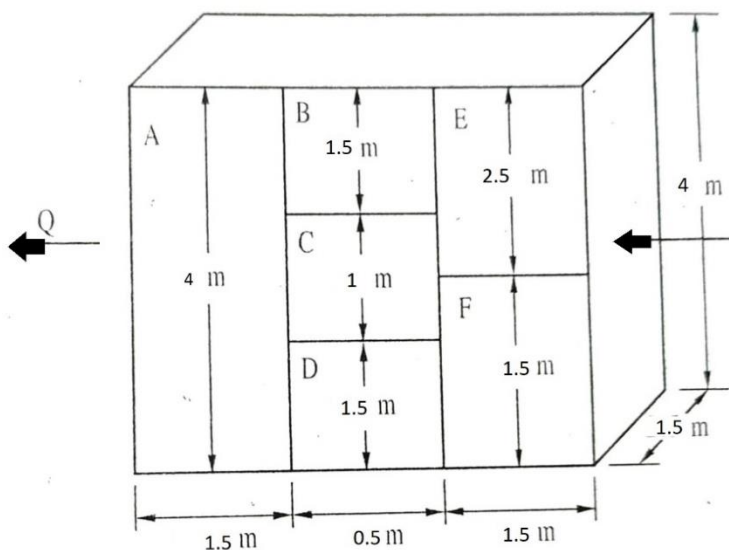
Q.NO.14. How will you classify the different types of Heat Exchanger on the basis of flow of fluid. Explain it in detail with suitable diagram. [8M] (C.O.No.3) [Application]

### Part C [Problem Solving Questions]

Answer all the Questions. Question carries FOURTEEN marks.

(3Qx14M=42M)

Q.NO.15 A composite wall is shown in the figure. Calculate the rate of heat flow through the solid only.  $K_A=16.6 \text{ W/m-k}$ ,  $K_B=3.7 \text{ W/m-k}$ ,  $K_C=4.2 \text{ W/m-k}$ ,  $K_D=1.6 \text{ W/m-k}$ ,  $K_E=2.8 \text{ W/m-k}$ ,  $K_F=1.3 \text{ W/m-k}$ ,  $h_i=6500 \text{ W/m}^2\text{-k}$ ,  $h_o=2000 \text{ W/m}^2\text{-k}$ ,  $T_i=800 \text{ k}$ ,  $T_o= 80 \text{ K}$ .



[14M] (C.O.No.1) [Application]

Q.NO.16. A furnace wall consists of 35 cm of fire brick, 25 cm of common brick and a 15cm thick steel plate on the outside. If the inside surface temperature of the furnace is 1800'K and outside surface temperature is to be 120'K. Calculate the temperatures between the layers and the heat flow by conduction of furnace wall. Take  $K$  for fire brick= $2.18 \text{ W/m-k}$ ,  $k$  for steel  $58.57 \text{ W/m-k}$ ,  $k$  for common brick= $0.74 \text{ W/m-k}$ ,  $h_i=4000$ ,  $h_o=2000$ . (Take Area= $1\text{m}^2$ )

[14M] (C.O.No.1) [Application]

Q.NO.17. Suppose we are boiling water in a pan. What are the different stages of boiling? Explain it in detail with suitable diagram.

[14M] (C.O.No.3) [Application]