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5E1322

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5E1322

B.Tech. V - Semester (Main) Examination, Nov. - 2019
PCC/PEC Mechanical Engg.
5ME4-02 : Heat Transfer
(Common For ME,AE)

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

*Attempt **all ten** questions from **Part A**, **five** question out of **Seven** from **Part B** and **Four** questions out of **Five** from **Part C**.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

1. ***Heat Transfer Data Book***

Part - A

(Answer should be given up to **25** words only)

All questions are **compulsory** **(10×2=20)**

1. What is heat transfer?
2. Convective heat transfer depends on which factors?
3. Explain Newton's law of cooling.
4. Write formula for radiation heat transfer between two surfaces.
5. Classify heat exchangers.
6. Write formula of LMTD for counter flow heat exchanger.
7. Construct the pool boiling curve.
8. What is drop wise condensation?
9. Construct the black body.
10. What is shape factor?

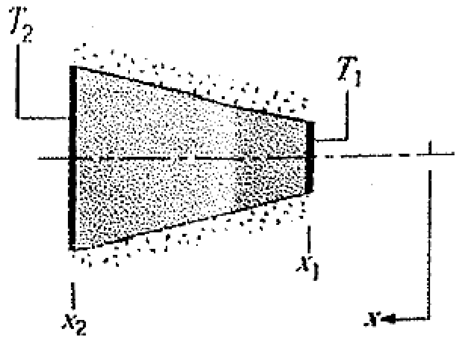
Part - B

(Analytical/Problem solving questions)

Attempt any **five** questions **(5×8=40)**

1. Explain the basic principle of the conduction, convection and radiation.

2. The diagram shows a conical section fabricated from Pyroceram (k = 3.46 W/m K). It is of circular cross section with the diameter D = ax, where a = 0.25. The small end is at x_1 = 50 mm and the large end at x_2 = 250 mm. The end temperature are T_1 = 400 K and T_2 = 600 K, while the lateral surface is well insulated.



   a) Derive an expression for the temperature distribution T(x) in symbolic form, assuming one - dimensional conditions. Sketch the temperature distribution.

   b) Calculate the heat rate q_x through the cone.

3. Derive an expression and explain the critical radius of insulation for a long cylinder.

4. A person sits in a room with surrounding air at 26°C and convection coefficient over the body surface is 6 W/m²K. The walls in the room are at 5°C as the outside temperature is below freezing. If the body temperature is 37°C, determine the heat losses by convection and radiation. Assume F = 1.0 for radiation. Consider a surface area of 0.8m².

5. Define Nusselt, Reynold's Prandtl and Stanton number. Explain their significance in forced convection.

6. What is fin? Derive an expression of fin efficiency for an extended rectangular fin.

7. State and explain Planck's distribution law of radiation.

Part - C

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any **Four** questions **(4×15=60)**

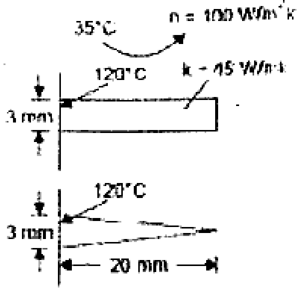
1. Derive an expression of conduction equation for the cylindrical coordinates.

2. Determine the heat flow for

   (i) rectangular fins and

   (ii) triangular fin of 20 mm length and 3 mm base thickness.

   Thermal conductivity = 45 W/mK. Convection coefficient = 100 W/m^2K, base temperature = 120°C surrounding fluid temperature = 35°C. Determine also the fin effectiveness (using the charts).



3. Derive an expression for effectiveness of counter flow heat exchanger and show its temperature distribution.

4. Explain the film wise and drop wise condensation with neat sketch.

5. Consider the 5 m× 5 m × 5 m cubical furnace (shown in Figure), whose surfaces closely approximate black surfaces. The base, top, and side surfaces of the furnace are maintained at uniform temperatures of 800 K, 1500 K, and 500 K, respectively. Determine :

   a) the net rate of radiation heat transfer between the base and the side surfaces,

   b) the net rate of radiation heat transfer between the base and the top surface, and

   c) the net radiation heat transfer from the base surface.