Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
MID TERM EXAMINATION - APR 2023

Semester : Semester VI - 2020
Course Code : MEC3003
Course Name : Sem VI - MEC3003 - Heat and Mass Transfer
Program : MEC

Date : 12-APR-2023
Time : 9.30AM - 11.00AM
Max Marks : 60
Weightage : 30%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **(5 X 2 = 10M)**

1. Define Thermal Conductivity.
(CO1) [Knowledge]
2. Define Black Body. Does Thermally black body always appear black to human eye(Yes/No)
(CO1) [Knowledge]
3. Define Convection heat transfer with an example.
(CO1) [Knowledge]
4. Define Radiation heat transfer with an example.
(CO1) [Knowledge]
5. Explain Newton's law of cooling with equation.
(CO1) [Knowledge]

PART B

ANSWER THE FOLLOWING QUESTION **(1 X 10 = 10M)**

6. What is Fourier Law of Conduction. With neat and clean diagram derive Fourier Law of Conduction. Also integrate fourier law and obtain the final equation of heat transfer.
(CO1) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(4 X 10 = 40M)**

7. A steel ball of 20 mm diameter at 1000 K is required to be cooled to 350 K by immersing it in a water environment at 300 K. The convective heat transfer coefficient is 1000 W/m^2-K. Thermal conductivity of steel is 40 W/m-K. The time constant for the cooling process is 18 second. Find the time required (in s) to reach the final temperature.

(CO1) [Application]

8. A metal ball of diameter 60 mm is initially at 220°C. The ball is suddenly cooled by an air jet of 20°C. The heat transfer coefficient is 200 W/m^2-K. The specific heat, thermal conductivity and density of the metal ball are 400 J/kgK, 400 W/mK and 9000 kg/m^3, respectively.Find the ball temperature (in °C) after 2 minutes.

(CO1) [Application]

9. A material P of thickness 1 mm is sandwiched between two steel slabs, as shown in the figure below. A heat flux 10 kW/m^2 is supplied to one of the steel slabs as shown. The boundary temperatures of the slabs are indicated in the figure. Assume thermal conductivity of this steel is 10 W/mK. Considering one-dimensional steady state heat conduction for the configuration, Find the thermal conductivity (k, in W/mK) of material P.

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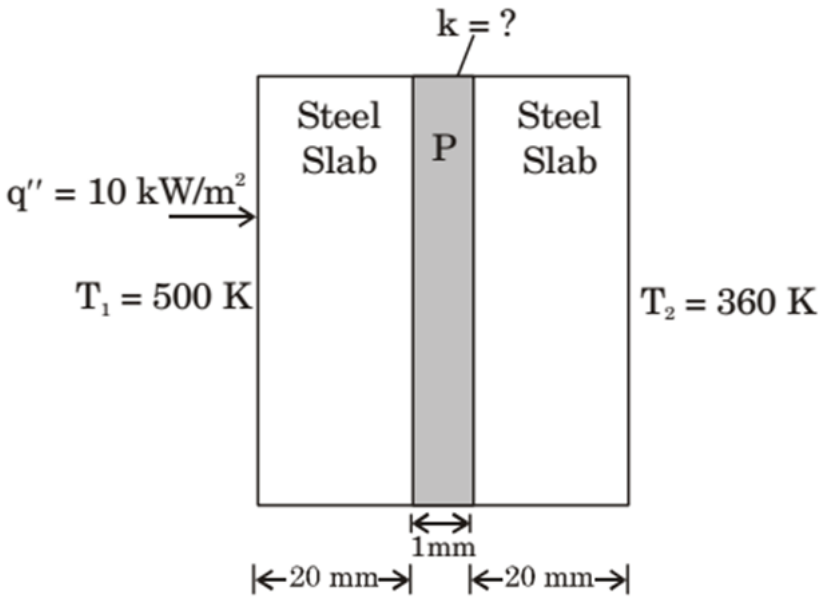

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(CO1) [Application]

10. A fin has 10 mm diameter and 100 mm length. The thermal conductivity of fin material is 400 W/m-K. One end of the fin is maintained at 130°C and its remaining surface is exposed to ambient air at 30°C. If the convective heat transfer coefficient is 40 W/m^2-K, Find the heat loss (in W) from the fin.

(CO1) [Application]