Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
MID TERM EXAMINATION - OCT 2023

Semester : Semester III - 2022

Course Code : PET2008

Course Name : Sem III - PET2008 - Heat and Mass Transfer for Petroleum Engineering

Program : B. TECH

Date : 31-OCT-2023

Time : 11:30AM -1:00PM

Max Marks : 50

Weightage : 25%

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 the co-efficient of thermal conductivity. State one example which has good conductivity.
(CO1) [Knowledge]

2. Describe radiation and list one example.

(CO1) [Knowledge]

3. Describe conduction and provide an example.

(CO1) [Knowledge]

4. Define thermal resistance and state the general formula for its calculation

(CO1) [Knowledge]

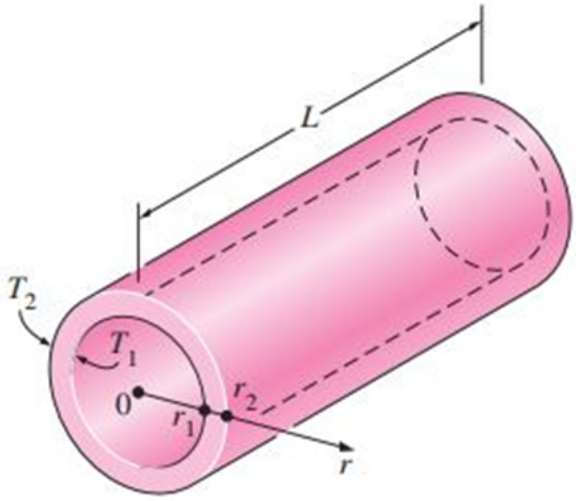
5. Define convection. Write down one example.

(CO1) [Knowledge]

PART B

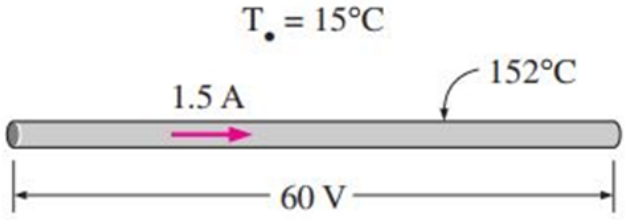
ANSWER ALL THE QUESTIONS **(2 X 10 = 20M)**

6. Consider a steam pipe of length L = 20 m, inner radius r1 = 6 cm, outer radius r2 = 8 cm, and thermal conductivity k = 20 W/m · °C, as shown in Figure. The inner and outer surfaces of the pipe are maintained at average temperatures of T1 = 150°C and T2 = 60°C, respectively. Predict a general relation for the temperature distribution inside the pipe under steady conditions, and estimate the rate of heat loss from the steam through the pipe.



(CO1) [Comprehension]

7. A 2-m-long, 0.3-cm-diameter electrical wire extends across a room at 15°C, as shown in Fig. Heat is generated in the wire as a result of resistance heating, and the surface temperature of the wire is measured to be 152°C in steady operation. Also, the voltage drop and electric current through the wire are measured to be 60 V and 5 A, respectively. Disregarding any heat transfer by radiation, estimate the convection heat transfer coefficient for heat transfer between the outer surface of the wire and the air in the room.

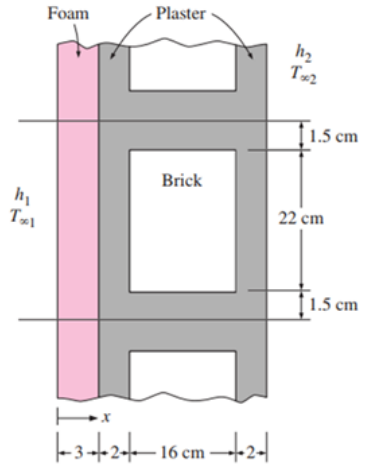


(CO1) [Comprehension]

PART C

ANSWER THE FOLLOWING QUESTION **(1 X 20 = 20M)**

8. A 3-m-high and 5-m-wide wall consists of long 16-cm 22-cm cross section horizontal bricks (k =0.72 W/m · °C) separated by 3-cm-thick plaster layers (k=0.22 W/m · °C). There are also 2-cm-thick plaster layers on each side of the brick and a 3-cm-thick rigid foam (k = 0.026 W/m · °C) on the inner side of the wall, as shown in Fig. The indoor and the outdoor temperatures are 20°C and -10°C, and the convection heat transfer coefficients on the inner and the outer sides are h1 = 10 W/m2 · °C and h2 = 25 W/m2 · °C, respectively. Assuming one-dimensional heat transfer and disregarding radiation, determine the rate of heat transfer through the wall.



(CO1) [Application]