Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	HEAT TRANSFER
COURSE CODE	:	BNL 30703
PROGRAMME CODE	:	BNL
EXAMINATION DATE	:	JANUARY 2021/FEBUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS. **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) List **THREE (3)** types of heat transfer modes and explain the differences.

(8 marks)

(b) Energy transfer is the movement of energy from one location to another. One type of energy can change into another type of energy. Explain the mechanisms of energy transfer to a closed system. Shown is heat transfer distinguish from the other forms of energy transfer.

(6 marks)

(c) Thermal conductivity often refers to the intrinsic ability of a material to transfer or conduct heat. Define thermal conductivity by your own understanding and explain its significance in heat transfer.

(6 marks)

Q2 (a) Consider a medium in which the heat conduction equation is given in its simplest form as

$$\frac{\partial^2 T}{\partial x^2} = \frac{1}{\alpha}\frac{\partial T}{\partial t}$$

(i) Choose is heat transfer steady or transient?

(2 marks)

(ii) Choose is heat transfer one-, two-, or three- dimensional?

(2 marks)

(iii) Choose is there heat generation in the medium?

(2 marks)

(iv) Choose is the thermal conductivity of the medium constant or variable?

(2 marks)

(b) An aluminum fin 1.5 mm thick is placed on a circular tube with 2.7-cm OD. The fin is 6 mm long. The tube wall is maintained at 150°C, the environment temperature is 15°C, and the convection heat-transfer coefficient is 20 W/m^2°C.
Calculate the heat lost by the fin.

(12 marks)

Q3 Derive the equation of temperature distribution and the heat transfer rate along a plane wall under steady state conditions without internal heat generation considering the boundary conditions shown the **Figure Q3** where : $T(x_1) = T_1$ and $T(x_2) = T_2$.

(20 marks)

Q4 Cold water (C_p=4180 J/kg · °C) leading to a shower enters a thin-walled double-pipe counter-flow heat exchanger at 15°C at a rate of 0.25 kg/s and is heated to 45°C by hot water (C_p=4190 J/kg°C) that enters at 100°C at a rate of 3 kg/s.

(i) calculate the rate of heat transfer coefficient is 1210 W/m^2 °C and

(8 marks)

(ii) the heat transfer surface area of the heat exchanger.

(12 marks)

Q5 A spherical container of inner radius r_1=2 m, outer r_2= 2.1 m, and thermal conductivity k = 30 W/m°C is filled with iced water at 0°C. The container is gaining heat by convection from the surrounding air at T = 25°C with a heat transfer coefficient of h = 18 W/m^2· °C. Assuming the inner surface temperature of the container to be 0°C.

(i) express the differential equation and the boundary conditions for steady one-dimensional heat conduction through the container,

(5 marks)

(ii) analyze a relation for the variation of temperature in the container by solving the differential equation, and

(5 marks)

(iii) evaluate the rate of heat gain to the iced water.

(10 marks)

-END OF QUESTIONS-

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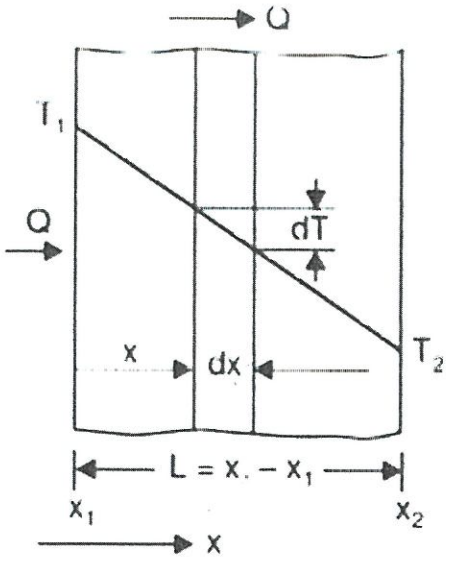

Figure Q3