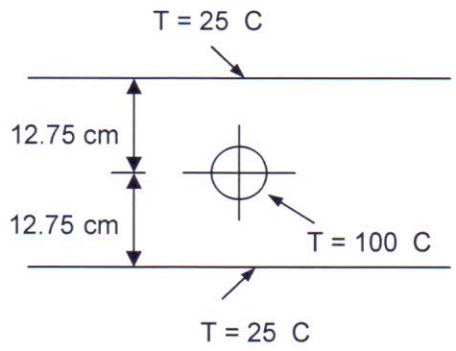
Misurata University — Faculty of Engineering
Fall- 2015 — (3 hours)
Heat Transfer (MSE 312), Final Exam — 30 /3 / 2015
Student name: — No:

Question 1: (*Each part carries 4 marks*)
A - Write the overall equation for conservation of energy.

B – Show the velocity and temperature profiles at the entrance of a circular pipe.

C – Show how abeam of rays falling on a thin plate interacts with it.

Question 2: (*A- 6 marks, B- 8 marks*)
A: Calculate the heat transfer rate per meter of a pipe with a diameter of (2.54 cm) located in a wall as shown below, knowing that the thermal conductivity of the wall is (30 W/m ^{o}K).



B- Steel plate of diameter (1.5 cm) was heated to (850 ^{o}C). Find the time it requires to cool to (100 ^{o}C) when exposed to air at ambient temperature (25 ^{o}C) and (h = 150 W/m^{2} ^{o}K). Knowing that.

$$\rho = 1 \times 10^{-5}\ (m^2/s)$$
$$k = 30\ (W/m\ ^{o}K)$$

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Question 3: (*A- 12 marks, B- 8 marks*)
A: A long metal plate with a thickness of (7 cm) at a temperature of ((600 ^{o}C). The plate was exposed to air with a temperature of (25 ^{o}C) and a convective heat transfer coefficient (h = 285 W/m^{2}-^{o}K. Calculate the temperature at its center after (15 min) of cooling. Also, what is the temperature at a distance (1 cm) from its surface after this time period? Knowing that the diffusivity and thermal conductivity of the plate are ($\alpha = 2 \times 10^{-5}$ m^{2}/s) and (k = 40 W/m-^{o}K), respectively.

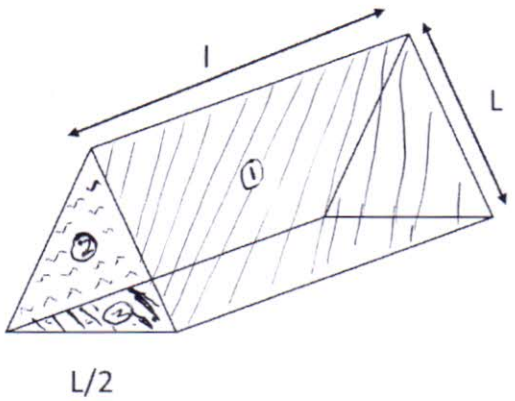
B- Water flows through a circular pipe (D = 2 in) with a velocity of (1.4 ft/s). Determine the type of flow and entrance length if water has the following properties:

$$\rho = 62.11 \text{ (lb/ft}^3\text{)}$$
$$\mu = 2.3 \text{ (lb/ft-hr)}$$

Question 4: (*A- 6 marks, B- 8 marks*)

A- Calculate the energy emitted from the surface of a body at a temperature of 750°C and emissivity ($\varepsilon = 0.7$). Knowing that ($\sigma = 5.6697 \times 10^{-8}$ W/m^2-K^4).

B- Find the shape factor $(F_{2\text{-}1})$



End of Exam