

AE331 HEAT TRANSFER

Online Midterm

December 17, 2020

(open notes and books)

Rules for the midterm

1. Your camera and microphone should be open during the quiz (you can reduce your speaker's volume if the voice is bothering you but you should not reduce the volume of your microphone)
2. You should not communicate with anybody during the quiz.
3. You should sit in front of your computer where the assistants can clearly see you even if you finish the quiz earlier.
4. You should be alone during the quiz.
5. Please sign the following statements and upload this page with your solution papers.

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I affirm that all the work done on this quiz is my own; have obeyed the rules indicated above and I have not given or received any help during this quiz. I understand that any indication of violation of this word of honor may lead to a zero grade on this quiz and to a disciplinary action.

Name: _____

ID number: _____

Date/Signature: _____

Question 2

Duration: 30 min for solution + 10 min for uploading

Assume that a spherical solid object is immersed in a water pool. Water has a temperature of $30b$ [K]. The diameter of the sphere is $0.00b$ [m]. The solid object is made of a material which has a thermal conductivity coefficient of $2b$ [W/mK], a density of $80ab$ [kg/m³] and a specific heat of $5ab$ [J/kgK]. The convective heat transfer coefficient between the solid surface and water is $5ab$ [W/m²K]. Thermal energy generation occurs inside solid object with a rate of $b \times 10^8$ [W/m³].

- a) Check if the lumped capacitance method is suitable for this problem.
- b) Calculate the steady state temperature of the object.
- c) How long does it take for the object to reach a temperature that is within 1 [K] of the steady-state value?

Where "a" and "b" are the symbols that represent the last two digits of your id number. For example, if your id number is 7134251 = 71342ab, then a=5, b=1. (If any of these symbols has a zero value and cause difficulties in the solution, you can replace this value with the third digit of your id number)

