MICHAEL DELACRUZ
MET 440
HW 1.1

1] A WINDOW GLASS 0.5 cm THICK WITH THERMAL CONDUCTIVITY 0.8 W/(m·°C) IS MAINTAINED AT 30°C AT ONE SURFACE & 20°C AT THE OTHER SURFACE. DETERMINE THE HEAT FLOW RATE ACROSS A $1 m^2$ SURFACE AREA OF THE GLASS.

GIVEN

$K = 0.8\ W/(m \cdot °C)$
$T_1 = 30°C$
$T_2 = 20°C$
$L = 0.5\ cm$
$A = 1 m^2$

FIND Q

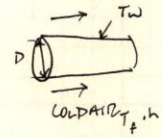
$Q = K \frac{A}{L} \Delta T$

$\Delta T = 30°C - 20°C = 10°C$
CONVERT 0.5 cm TO m = 0.005 m

SOLVE

$Q = 0.8 \frac{W}{m \cdot °C} \cdot \frac{1 m^2}{0.005 m} \cdot 10°C$
$= 1600\ W$
$= \boxed{1.6\ kW}$

2] COLD AIR AT 10°C FLOWS OVER A 2 cm OD TUBE. THE OUTSIDE SURFACE OF THE TUBE IS MAINTAINED AT 110°C. IF THE HEAT TRANSFER COEFFICIENT BETWEEN THE OUTSIDE SURFACE OF THE TUBE AND THE AIR IS 100 W/(m².°C), DETERMINE THE RATE OF HEAT FLOW TO THE AIR OVER THE 5m LENGTH OF THE TUBE



$L = 5m$
$\Delta T = 110°C - 10°C = 100°C$
$h = 100\ W/(m^2 \cdot °C)$
$OD = 2 cm$
$A = \pi r^2 = \pi (0.002 m)^2 = 0.000013 m^2$

$q = 100\ W/(m^2 \cdot °C)\ (10°C - 110°C) = -10000\ W/m^2$

$Q = qA = (10000\ W/m^2)(0.000013\ m^2) = \boxed{0.125\ W}$

$Q = hA(\Delta T)$
$= 100\ W/(m^2 \cdot °C) \times (2\pi(0.002) \times 5) \times (110°C - 10°C)$
$= 314.159\ W$
$= \boxed{314.16\ W}$

[25] A RADIATION FLUX OF 1000 W/m^2 IS INCIDENT UPON A SURFACE THAT ABSORBS 80 PERCENT OF THE INCIDENT RADIATION. CALCULATE THE AMOUNT OR RADIATION ENERGY ABSORBED BY A $4 m^2$ AREA OF THE SURFACE OVER A PERIOD OF 2 HRS.

GIVEN
RADIATION FLUX = 1000 W/m^2
INCIDENT = 80 %.
$A = 4m^2$
T = 2 HRS

SOLVE:

INCIDENT RADIATION = $1000\ W/m^2 \times 0.8 = 800\ W/m^2$

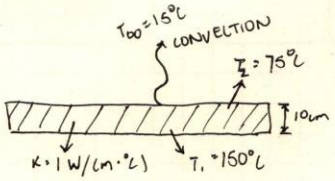
$800\ W/m^2 \cdot 4m^2 = 3200\ W$

CONVERT 2 HRS TO SEC

$$2 \times \frac{60\ min}{1\ hr} = 120 \times \frac{60\ sec}{1\ min} = 7200\ sec$$

$$3200 \times 7200 = 23040000\ W/sec = 23040000\ J$$
$$= 23040\ KJ$$
$$= \boxed{23.04\ MJ}$$

[29] THE INSIDE SURFACE OF AN INSULATION LAYER IS MAINTAINED AT 150°C AND THE OUTSIDE SURFACE DISSIPATES HEAT BY CONVECTION INTO AIR AT 15°C. THE INSULATION LAYER HAS A THICKNESS OF 10 cm AND A THERMAL CONDUCTIVITY OF 1 W/m·°C). WHAT IS THE MINIMUM VALUE OF THE HEAT TRANSFER COEFFICIENT AT THE OUTSIDE SURFACE, IF THE TEMPERATURE AT THE OUTSIDE SURFACE SHOULD NOT EXCEED 75°C? CALCULATE THE INCREASE IN ITS EMISSIVE POWER



SOLVE

$$\frac{KA(\Delta T)}{L} = hA(\Delta T)$$

$$\frac{1\ W/(m^2 \cdot °C) \cdot A \cdot (150 - 75)°C}{0.1\ m} = hA\ (75 - 15)°C$$

$$750\ W/m^2 \cdot A = 60°C \cdot h \cdot A$$

$$\frac{750\ W/m^2}{60°C} = h$$

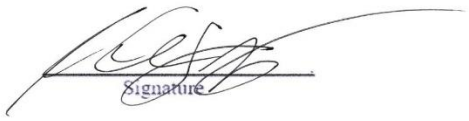
$$\boxed{h = 12.5\ W/(m^2 \cdot °C)}$$

11.5 Withdrawal
A syllabus constitutes an agreement between the student and the course instructor about course requirements. Participation in this course indicates your acceptance of its teaching focus, requirements, and policies. Please review the syllabus and the course requirements as soon as possible. If you believe that the nature of this course does not meet your interests, needs or expectations, if you are not prepared for the amount of work involved - or if you anticipate that the class meetings, assignment deadlines or abiding by the course policies will constitute an unacceptable hardship for you - you should drop the class by the drop/add deadline, which is located in the ODU Schedule of Classes. For more information, please visit the Office of the University Registrar.

12. Student Help Resources

12.1 Online Student Orientation: http://www.clt.odu.edu/oso
12.2 Blackboard Support Website: http://www.clt.odu.edu/bb
12.3 Technical Support Center: http://occs.odu.edu/, occshelp@odu.edu, 757-683-3192
12.4 Study Guides Strategies: http://www.studygs.net/
12.5 Papers Citation Styles: MLA, APA, Chicago & CBE:
http://www.dianahacker.com/resdoc
12.6 Student Acknowledgement

I, MILHAEL DELACRUZ, have completely read this syllabus and understand and agree to the course requirements.



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