ME 304: Heat Transfer

This is a cooperative course taught jointly by WSU and the University of Idaho

Course description:	Conduction, radiation, and convection heat transfer; analytical, numerical, experimental results for solids, liquids, and gases; heat exchanger design.
Number of credits:	3. This course is required.
Course Coordinator:	R. Richards
Prerequisites by course:	ME 301; ME 303; certified major in Mechanical Engineering
Prerequisites by topic:	1. Differentiation 2. Integration 3. Conservation of mass 4. Conservation of momentum 5. Conservation of energy
Postrequisites:	ME 402, ME 406, ME 416, ME 419
Textbooks/other required materials:	Y.A. Cengel and A.J. Ghajar. *Heat and Mass Transfer: Fundamentals and Applications.* McGraw-Hill, 4/e, 2011.
Course objectives:	1. Understand the modes of heat transfer and thermo-physical properties 2. Application of energy conservation equation for thermal problems 3. Calculate temperature and heat flux in one and two-dimensional conduction 4. Calculate temperature and heat flux in unsteady conduction 5. Understand velocity and thermal boundary layers 6. Use boundary layer theory to determine velocity and temperature profile in external flows 7. Evaluate heat transfer in internal flows for both developing and fully developed regions 8. Calculate heat transfer rate and effectiveness of different heat exchangers 9. Understand radiation properties and surfaces for heat transfer 10. Calculate radiative heat transfer rate among surfaces
Topics covered:	1. Introduction and basic concepts 2. Introduction to conduction 3. One-dimensional, steady-state conduction 4. Two-dimensional, steady-state conduction 5. Transient conduction

6. Introduction to convection
7. External flow heat transfer
8. Internal flow heat transfer
9. Natural convection heat transfer
10. Heat exchangers
11. Radiation heat transfer

Expected learning outcomes:

1. Ability to formulate governing partial differential equation(s) and necessary boundary (and initial) conditions for any thermal problem
2. Ability to determine the temperature and heat flux distribution using energy conservation and/or Fourier heat law
3. Ability to determine the heat flux and temperature distribution in steady state one-dimensional problems using thermal resistance concept
4. Ability to use numerical and/or graphical techniques to the find temperature distribution in two- and three-dimensional problems
5. Ability to apply analytical techniques to find the temperature distribution in transient conduction problems
6. Ability to use the energy transport equation to determine the temperature and heat flux distribution in laminar flow
7. Ability to determine the heat flux in turbulent flows using empirical equations
8. Ability to estimate the heat transfer rate for different heat exchangers
9. Ability to calculate different radiative properties associated with heat transfer

Class schedule: Three 50-minute lecture sessions per week, for one semester.

Laboratory schedule: None

Contribution to meeting the professional component: Engineering Topics

Relationship of course to student outcomes:
3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018 (ABET EC2000)

a	b	c	d	e	f	g	h	i	j	k
2				3						

Student Outcomes Fall 2018 forward (ABET EC2019)

1	2	3	4	5	6	7
3						

Prepared by: Andrea Butcherite and R. Richards *Date:* May 30, 2018