Course Number	**ME 407**		
Course Title	**Heat Transfer**		
Course Structure	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)		
Course Coordinator	Eon Soo Lee		
Course Description	A study of the three fundamental modes of heat transfer: conduction, convection, and radiation. A physical interpretation of the many quantities and processes in heat transfer using numerical methods. Theory is applied to the analysis and design of heat exchangers and other applications. Where appropriate, computer simulation is used.		
Prerequisite(s)	Math 222 – Differential Equations ME 304 – Fluid Mechanics ME 311 – Thermodynamics I		
Required, Elective or Selected Elective **Corequisite(s)**	Required None		
Required Materials	Frank P. Incropera and David P. DeWitt An Introduction to Heat Transfer, 6th edition. John Wiley & Sons 2012		
Other supplemental materials	Computer software available from the textbook and ME CAD room and other sources.		
Computer Usage	Use existing software to solve practical heat transfer problems as demonstrated in the project reports.		
Course Learning Outcomes/ expected performance criteria:	1. **mathematically** describe different practical heat transfer problems including governing equations together with boundary and initial conditions	1, 3, 4	**Homework** (80% o the students will earn a grade of 70% or better)
	2. **solve** the heat transfer problems for a range of practically important simplified configurations and symmetries, including one-dimensional problems in cylindrical and spherical coordinates	1, 2, 4	**Homework** (80% o the students will earn a grade of 70% or better)
	3. **use** generic data processing software to solve heat transfer problems	4	**Homework, Project** (80% o the students will earn a grade of 70% or better)
	4. **apply** finite difference methods for transient heat transfer in a solid with or without distributed heat sources	2,5	**Homework** (80% o the students will earn a grade of 70% or better)
	5. **describe** engineering heat transfer problems using non-	6	**Homework** (80% o the students will earn

	dimensional criteria, such as Reynolds number, Nusselt number, Rayleigh number, etc		a grade of 65% or better)
	6. **determine** engineering design quantities (power, requirements, insulation thickness, thermal conductivity, exchanger size, etc.) required for design of thermal engineering devices and systems	2, 4	**Homework, Project** (80% o the students will earn a grade of 70% or better)

Class Topics

1. Introduction to heat transfer
2. Introduction to conduction heat transfer
3. Steady heat conduction problems
4. Fins, common fin shapes and models
5. Quiz 1: steady conduction heat transfer, fins
6. Intro to transient heat transfer problems, lumped system
7. Transient heat transfer in solids: analytical solutions
8. Steady heat transfer: numerical analysis
9. Transient heat transfer: numerical methods
10. Quiz 2: transient heat transfer
11. Heat transfer design project: introduction
12. Introduction to convection heat transfer
13. Forced convection, external/internal flows
14. Natural convection
15. Quiz 3: Convection heat transfer
16. Solving practical radiation heat transfer problems
17. Heat Exchangers
18. Introduction to radiation
19. Review
20. Comprehensive Final Exam

Student Outcomes (Scale: 1-3)

SOs*	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Scale	3	3	2	3	1	3	

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes.