Designation as a ‘Required’ or ‘Elective’ course
TYPE OF COURSE: Required for BSME Major

Course (catalog) description

Prerequisite(s)
PREREQUISITE(S): ME 205 Thermodynamics and ME 211 Fluid Mechanics I.

Textbook(s) and/or other required material

Course objectives
COURSE OBJECTIVES: Students learn to formulate engineering problems in the three modes of heat transfer and to obtain mathematical solutions using a variety of techniques in calculus and differential equations. In teams, students learn to conduct laboratory experiments and analyze data in heat transfer applications. Written communications are taught through laboratory reports. Heat transfer equation solver software is used in conjunction with course assignments. It facilitates “what-if: analysis.

Topics covered
MAJOR TOPICS:
1. Introduction to heat transfer
2. General Heat conduction equation
3. Heat conduction applications
   LAB (Axial Heat Conduction in Rods)
4. Fin theory and design of fins
   LAB (Composite Cylindrical Fins)
5. Two-dimensional conduction; graphical, analytical and numerical
   LAB (Two Dimensional Conduction in Irregular Geometries)
6. Unsteady heat conduction; analytical and numerical
   LAB (Transient Convection Heat Transfer)
7. Boundary layer equations and integral analysis
8. Convection applications; internal and external
9. Heat Exchangers
   LAB (Heat exchangers)
10. Radiative properties and shape factors
11. Electrical analogue to radiation
12. Examinations

Total: 45 + 30 hours of lab incorporating above topics
Class/laboratory schedule, i.e., number of sessions each week and duration of each session
CREDIT HOURS: 3 hours
TYPE OF INSTRUCTION:

<table>
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<tr>
<th>Type of Instruction</th>
<th>Contact Hours/Week</th>
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<tbody>
<tr>
<td>Lecture/Discussion</td>
<td>3</td>
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<tr>
<td>Laboratory</td>
<td>2</td>
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Contribution of course to meeting the professional component
The course presents a mathematical treatment of the physical phenomenon of heat transfer in applied engineering situation. Real engineering situations are used in examples, out of class problems, and examinations. Heat transfer differential equation solving software is used in conjunction with course assignments. A laboratory component is included in which students take and analyze measurements on real systems.

Relationship of course to program outcomes
As shown in the BSME Course Outcomes Matrix:
- A. Ability to apply math, science & engineering
- B. Ability to design & conduct experiments and to analyze and interpret data
- E. Ability to identify, formulate, and solve engineering problems
- G. Ability to communicate effectively
- J. Knowledge of contemporary issues
- K. Ability to use techniques, skills and modern engineering tools

Person(s) who prepared this description and date of preparation
W.J. Minkowycz, Professor of Mechanical and Industrial Engineering, January 16, 2008

Comments on outcomes
Following are possibly approaches to incorporating specific student learning outcomes into this course:
G Ability to communicate effectively. Laboratory reports give students feedback, beyond the technical content, concerning communication skills (format, clarity, etc.).
K Ability to use modern engineering tools. The text by Incropera and Dewitt includes equation solving software with specific application to heat transfer. Learning and using it in this course gives students an excellent tool for future engineering applications.

These outcomes are what students are expected to gain from this course.