# ME 332 HEAT TRANSFER

**Credit: 3(3-0-6)** **Semester 2 Year 2006**
**Prerequisite:** ME 241 (Mechanics of Fluid), ME 331 (Thermodynamics for Mechanical engineer)

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**Instructor:** Chainarong Chaktranond
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**Lecture time:** Thrus (9.30 – 12.30)

**Consulting hours:** Monday 13.30 – 16.00 or make an appointment via email

**Objectives:** Students are expected to

1. To understand the basic principles of heat transfer
2. To be able to analyze the thermal applications and equipments

## Course Description:

Basic principles of heat transfers; conduction, convection, and radiation equations. Analysis of heat transfers in plane and cylindrical surfaces, as well as, black body. Basic knowledge on heat exchangers.

## Teaching Schedule:

| Session | Topics |
|---|---|
| 1 | **1. Basics of Heat transfer**<br>Overviews and importance of heat transfer in real applications; Basic modes of heat transfer – conduction, convection, radiation – |
| 2 | **2. Heat conduction equation**<br>1, 2, 3 dimensional equations, various coordinates; Cartesian, Cylindrical, Spherical coordinates, Steady and Unsteady heat conduction equations. |
| 3 - 4 | **3. Heat conduction equation**<br>Solving the exact solution of heat conduction equations, Boundary and initial condition, heat transfer in solid, variable thermal conductivity |
| 5 - 6 | **4. Steady heat conduction**<br>Steady heat transfer in plane walls, Thermal contact resistances, Heat conduction in cylinder and sphere, Critical radius of insulation |
| 7 - 9 | **5. Heat transfer from finned surfaces**<br>Fin equations, Fin efficiency, Fin effectiveness, Proper length of fin |
| 10 - 11 | **6. Transient heat conduction**<br>Lump system analysis, transient heat transfer in large plane walls, long cylinder and sphere with spatial effects, Transient heat transfer in semi-finite solid |
| 12 | **7. External force convection**<br>Physical mechanism on convection heat transfer, Nusselt number, Velocity boundary layer, Thermal boundary layer, Equations of conservation, Parallel flow over flat plates, Flow across cylinders and spheres, Flow across tube banks |
| 13 | **8. Internal force convection**<br>Mean velocity and mean temperature, Entrance region, General thermal analysis, Laminar and turbulent flows in tube |

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| **14** | **9. Heat exchangers**<br>Types of heat exchangers, Overall heat transfer coefficient, Analysis of heat exchangers, Log mean temperature difference, The effectives – NTU method, Selecting heat exchangers |

## Material courses:

- Handout given by instructor (http://www.engr.tu.ac.th/~cchainar)

## Reference Books:

- Cengel, Y.A. Heat transfer: A practical approach, 2nd ed., McGraw-Hill.
- Incropera, F.P., and Dewitt, D.P. Fundamentals of heat and mass transfer, 3rd ed., John Wiley.

## Tentative evaluation:

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| Attendance, Quiz and Assignment | 20% |
| Mid-term Examination (topic 1 – 4) | 20% |
| 2nd Examination (topic 5 - 6) | 30% |
| Final Examination (topic 7 - 9) | 30% |
| Total | 100% |

## Evaluation

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| **≥ 80** | **A** |
| **74 - 79** | **B+** |
| **68 – 73** | **B** |
| **62 – 67** | **C+** |
| **56 – 61** | **C** |
| **50 – 55** | **D+** |
| **44 – 49** | **D** |
| **< 44** | **F** |