

<p>Kingdom of Saudi Arabia Ministry of Higher Education <b>Qassim University</b> College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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## Advanced Heat Transfer

**College:** *Engineering*

**Department:** *Mechanical Engineering*

**First: Course Definition**

**1- Course Code:** *ME 671*

**2- Units:** *3 credit hrs*

**3- Semester:**

**4- Prerequisite:**

**5- Co-requisite:**

**6- Location** (if not on main Campus):

**Second: Course Objectives**

- To provide students with insight into the nature of conduction, convection and radiation.
- To help students understand and explain heat transfer phenomena
- To help students develop the ability to calculate conduction, convection and radiation solutions: Simple to complex, analytical and numerical techniques.

**Third: Course Specifications**

**1- Topics to be covered:**

Subject	No of Weeks	Units
<i>1D and 2D conduction and applications</i>	2	6
<i>Transient conduction</i>	2	6
<i>Thermal boundary layers-free and forced convection</i>	2	6
<i>Boiling and condensation, pool boiling, two phase flow. Laminar and turbulent film condensation.</i>	2	6
<i>Heat exchangers: types, analysis and design procedure</i>	3	9
<i>Thermal radiation Processes and properties, blackbody radiation, Gray surfaces.</i>	2	6

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Radiation exchange between surfaces, view factor. Radiation between gases.	2	6
	Total	45 hours

## 2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	Total
45 hours	-----	45 hours

## 3- Intended Learning Outcomes of the Course (ILO's) :

### **a. Knowledge:**

#### **i) Description of the knowledge to be acquired:**

- To understand and solve equations in 1D/2D conduction in steady state and transient Conditions.
- To understand thermal boundary layers in free and forced convection.
- To understand the phenomenon of boiling and condensation.
- To study types of heat exchangers and derive equations and find a solution.
- To understand the thermal radiation, energy exchanged between surfaces and Gases.

#### **ii) Teaching strategies to be used to develop that knowledge:**

- Lectures with applications
- Group discussion to assess communication abilities
- Seminars
- Projects presented by students

#### **iii) Methods of assessment of knowledge acquired:**

- Quizzes to assess basic understanding
- Projects on related topics
- Homework assignments
- Mid term exam
- Final term exam

### **b- Cognitive (Intellectual) Skills:**

#### **i) Cognitive skills to be developed:**

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- To acquire ability to analyze and solve mathematically problems with boundary Conditions.
- to understand modelisation and its implementation.

**ii) Teaching strategies to be used to develop these cognitive skills:**

- Lectures and tutorials.
- Discussion in class .
- Homework assignments.

**iii) Methods of assessment of students' cognitive skills:**

- Their written Reports.
- examinations (quizzes, mid term and final exams).
- Case study reports

**c. Interpersonal Skills and Responsibility:**

**i) Description of the interpersonal skills and capacity to carry responsibility to be developed:**

- Team work.
- Ideas development and shearing with others (communication skills)

**ii) Teaching strategies to be used to develop these skills:**

- Lectures.
- Mini projects.
- Case study analysis.
- Homework assignment

**iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility:**

- Mini projects.
- Written reports.
- Students' seminars and presentations.

**d. Communication, Information Technology and Numerical Skills:**

**i) Description of the skills to be developed in this domain:**

- Modelisation and simulation of problems.
- Use of commercial codes for modeling.
- Writing of good technical reports.

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- ii) Teaching strategies to be used to develop these skills:**
- Lectures.
  - Case study analysis.
  - Mini projects.
- iii) Methods of assessment of students numerical and communication skills:**
- Mini projects.
  - Homework assignments.
  - Students' seminars and presentations.

**e. Psychomotor (if applicable) & Other Non-cognitive Skills :**

- i) Description of the psychomotor or other skills to be developed and the level of performance required:**
- No

- ii) Teaching strategies to be used to develop these skills :-**
- No

- iii) Methods of assessment of student's psychomotor skills:**
- No

**4- Student Assessment Schedule:**

Serial	Assessment tool (test, group project, examination etc.)	Week due	Weight
1	First Project – case study	Week 3	10 %
2	<b>Mid Term Exam</b>	Week 8-9	20 %
3	Second Term Project – case study	Week 10	10 %
4	Third Term Project – case study	Week 13	10 %
5	<b>Final Exam</b>	Week 16	50 %

**5- Student Support:**

- Providing electronic library of textbooks and scientific periodicals.
- Providing computer applications for the course.

**6- Learning Resources:**

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**i) Essential Books (References):**

- Incropera, DeWitt, Bergman, and Lavine Jone, *Fundamentals of Heat and Mass Transfer*, Wiley & Sons, 2005.
- John H. Lienhard IV and John H. Lienhard V. `A Heat Transfer Textbook`, 4<sup>th</sup> edition, Phlogiston Press, USA, 2011, [lienhard@mit.edu](mailto:lienhard@mit.edu)

**ii) Course Notes:**

- Dispatched during lectures

**iii) Recommended Books**

- Frank K. and Mark S. B., *Principles of Heat Transfer*, Harper & Row Publishers, New York, 1993.
- H. Schlichting, *Boundary Layer Theory*, 7<sup>th</sup> Ed., McGraw-Hill Company, 1979.

**iv) Electronic Books & Web Sites:**

- [www.ecs.umass.edu/mie/faculty/rothstein/mie606\\_fall02.pdf](http://www.ecs.umass.edu/mie/faculty/rothstein/mie606_fall02.pdf)
- [www.thermalfluidscentral.org/e-books/book-intro.php?b=37](http://www.thermalfluidscentral.org/e-books/book-intro.php?b=37)
- [www.nrel.gov/docs/fy05osti/37083.pdf](http://www.nrel.gov/docs/fy05osti/37083.pdf)
- [books.google.com/books?id=yxMnotbAAz4C&dq=Yuwen...1...](https://books.google.com/books?id=yxMnotbAAz4C&dq=Yuwen...1...)
- [www.engr.sjsu.edu/shabany/advht.html](http://www.engr.sjsu.edu/shabany/advht.html)
- [www.sciencedirect.com/science/bookseries/00652717](http://www.sciencedirect.com/science/bookseries/00652717)

**v) Periodicals:**

- [Periodical heat transfer in parallel-plate channel of... | Brown ... library.brown.edu/find/Summon/Record?id=FETCH-LOGICAL...](http://library.brown.edu/find/Summon/Record?id=FETCH-LOGICAL...)
- [Heat Transfer - IEEE Conferences, Publications, and Resources technav.ieee.org/tag/2831/heat-transfer](http://technav.ieee.org/tag/2831/heat-transfer)
- [List of engineering journals and magazines - Wikipedia, the free ...](http://en.wikipedia.org/wiki/List_of_engineering_journals_and_magazines)  
List of engineering journals and magazines. From Wikipedia, the free ... Mechanical engineering. 4.1 Heat Transfer, Fluid Flow and Energy; 4.2 Solid Mechanics ...  
[en.wikipedia.org/wiki/List\\_of\\_engineering\\_journals\\_and\\_magazines](http://en.wikipedia.org/wiki/List_of_engineering_journals_and_magazines)
- [Amazon.ca: Periodicals - Heat Transfer / Aerospace / Engineering www.amazon.ca/periodicals-Heat-Transfer.../s?...Periodicals...n%3A387206011%2Ck%3APeriodicals...](http://www.amazon.ca/periodicals-Heat-Transfer.../s?...Periodicals...n%3A387206011%2Ck%3APeriodicals...)
- [Holdings: Heat transfer engineering. https://ifind.swan.ac.uk/discover/Record/367780](http://holdings.swan.ac.uk/discover/Record/367780)
- Periodical heat transfer  
[kisi.deu.edu.tr/aytunc.erek/Proje2011/konu9.pdf](http://kisi.deu.edu.tr/aytunc.erek/Proje2011/konu9.pdf)
- [Journal of Heat Transfer - ASME www.asme.org/products/journals/journal-of-heat-transfer](http://www.asme.org/products/journals/journal-of-heat-transfer)

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## **7- Course Evaluation and Improvement Processes:**

### ***i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching:***

- Student`s assessment of course and instructor
- Questioners to be filled by instructor and students

### ***ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department:***

- External assessment
- Seminars on topics related to the course
- Through course file

### ***iii) Processes for Improvement of Teaching:***

- Inviting professors to give seminars on related topics
- External assessments on course and students` results

### ***iv) Processes for verifying standards of student achievement:***

- Through assessment of course file
- External instructor
- Through samples of students` results (exams)

### ***v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.:***

- Through a committee of evaluation in checking the outcomes.
- Through the students` assessment for continuous improvement process.

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