Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment [NCAAA]

ME 371 Thermodynamics (1)

COURSE SPECIFICATION

ME 371 Thermodynamics (1)

Course Specification

Institution:	King Saud University
College/Department:	College of Engineering – Department of Mechanical Engineering

A Course Identification and General Information

1. Course title and code: **Thermodynamics (1) ME 371**
2. Credit hours: 3(3,1,0)
3. Program(s) in which the course is offered: (If general elective available in many programs indicate this rather than list programs) B.Sc., Mechanical Engineering
4. Name of faculty members responsible for the course: Dr. Mohamed H. Morsy
5. Level/year at which this course is offered: Level 6
6. Pre-requisites for this course (if any): PHYS 104 (Physics)
7. Co-requisites for this course (if any):
8. Location if not on main campus:

B Objectives

1. Summary of the main learning outcomes for students enrolled in the course.

1. Understand the concepts of conservation of mass, conservation of energy, and the second law of thermodynamics.
2. Understand of the concepts of work interaction and heat transfer.
3. Be completely familiar with the methods used to determine thermodynamic properties of simple compressible substances.
4. Demonstrate an understanding of the first law of thermodynamics.
5. Demonstrate an understanding of the concepts of irreversibility, Carnot cycle, and Carnot principles.
6. Be able to identify realistic and unrealistic cycles and processes.
7. Understand the concept of entropy.
8. Be able to evaluate the entropy of pure substances including ideal gases.
9. Demonstrate an understanding of the concept of reversible work and isentropic efficiency.
10. Be able to identify closed and open systems.
11. Be able to identify work interactions and heat transfer .
12. Demonstrate the ability to determine the thermodynamic properties of simple compressible substances including incompressible substances and ideal gases.
13. Be able to apply the principles of conservation of mass, conservation of energy, and the second law of thermodynamics to the solution of problems .
14. Be able to apply the principles of conservation of mass, conservation of energy, and the second law of thermodynamics to thermodynamic cycles .
15. Demonstrate the ability to analyse the performance of vapor power cycles and to identify methods for improving thermodynamic performance .
16. Demonstrate the ability to analyse the performance of gas power and to identify methods for improving thermodynamic performance .

2. Briefly describe any plans for developing and improving the course that are being implemented. (E.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)

1. Encourage the students to use web based reference materials related to energy, energy crisis and pollution.
2. Active learning through class discussions during lecture and lab.
3. The course contents will be periodically reviewed by the instructors and the Undergraduate Committee to include new materials of relevance and improved teaching method.

C. Course Description

(Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1. Topics to be Covered		
List of Topics	No of Weeks	Contact hours
Introduction and Basic Concepts	2	6
Types of Energy Transfer, and General Energy Analysis	2	6
Properties of Pure Substances	1	3
Energy Analysis of Closed Systems	2	6
Mass and Energy Analysis of Control Volumes	2	6
The Second Law of Thermodynamics	1	3
Entropy, Carnot cycle and the reversed Carnot cycle	2	6
Rankin cycle	1	3
Vapor compression refrigeration cycles	2	6

2. Course components (total contact hours per semester):				
Lecture: 45	Tutorial: 15	Laboratory: Not applicable	Practical/Field work/Internship: Not applicable	Other:

3. Additional private study/learning hours expected for students per week. (This should be an average for the semester not a specific requirement in each week): 5 – 7 hours.

4. Development of Learning Outcomes in Domains of Learning

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

a. Knowledge

(i) Description of the knowledge to be acquired

1. Demonstrate an understanding of basic concept of thermodynamics including closed and open systems, thermodynamic properties, states and cycles.
2. Identify work and heat interactions.

3. Determine the thermodynamic properties of pure substances using property tables and the ideal gas equation.
4. Apply the principles of conservation of mass and energy applied on both closed and open systems.
5. Understand the second law of thermodynamics, the concepts of irreversibility, Carnot cycle, and Carnot principles.
6. Understand the concept of entropy and evaluate the entropy change of pure substances including ideal gases.
7. Identify the concept of reversible work and isentropic efficiency.

(ii) Teaching strategies to be used to develop that knowledge

1- Knowledge is delivered through the course lectures and tutorial hours.
2- Interactive learning process through questions and answers in lecture and lab.
3- Use internet to carry out independent study on some contemporary issues such as global warming and sustainable energy.

(iii) Methods of assessment of knowledge acquired

1. Exams and homework assignments are used to assess the acquired knowledge on the subject.
2. Short quizzes at the end of each topic are used to evaluate the student understanding.

b. Cognitive Skills

(i) Description of cognitive skills to be developed

1. The ability to identify different energy resources (renewable and traditional) and recognize the impact of energy usage on environment.
2. Analyze the performance of vapour power cycles and identifying methods for improving its performance.
3. Analyze the performance of gas power cycles and identifying methods for improving its performance.
4. The ability to apply engineering principles to analyze and improve processes and systems to accomplish desired objectives.
5. The ability to engage in life-long learning.

(ii) Teaching strategies to be used to develop these cognitive skills

1. Explanation and examples given in lectures help to transfer knowledge by the use of analytical tools and the use of questioning techniques during the learning process to consolidate knowledge and understanding.

(iii) Methods of assessment of students cognitive skills

- Use assignments which require application of analytical tools in problem solving.

c. Interpersonal Skills and Responsibility

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

1. To develop and improve students' skills, capacity for self-directed learning, taking initiatives, and bearing responsibilities.
2. Ability to carry out research and review for some contemporary issues such as global warming and sustainable energy.
3. Ability to communicate effectively.

(ii) Teaching strategies to be used to develop these skills and abilities

Carrying out a team projects -assignment (mini project) to cover some knowledge of contemporary issues related to the course.

(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- Writing term papers on some contemporary issues.

d. Communication, Information Technology and Numerical Skills

(i) Description of the skills to be developed in this domain.

- Reports are written using some computer software.
- Presenting the term paper using the power point presentation in front of the class.

(ii) Teaching strategies to be used to develop these skills

Feed back on self learning presentation techniques is used extensively during the course to improve the quality of delivered written reports.

(iii) Methods of assessment of students numerical and communication skills

The first submitted written report will be scrutinized and detailed individual feedback is given before the final submission.

e. Psychomotor Skills (if applicable) N.A.

5. Schedule of Assessment Tasks for Students During the Semester

Assessment	Assessment task (e.g. essay, test, group project, examination etc.)	Week due	Proportion of final assessment

1	Homework and Quizzes	Every week	10
2	Term project	10	10
3	First Mid Term Exam	8	15
4	Second Mid Term Exam	12	15
5	Final Exam	16	50

D. Student Support

Arrangements for availability of teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

1. Each faculty is required to be available in his office to devote at least 3 hr/week for students' consultation and academic advice.
2. Teaching assistance taking the tutorial is required to devote 1 hr/week for helping the students.

E Learning Resources

1. Required Text(s)

Thermodynamics: An Engineering Approach, by Cengel and Boles, 6th or Latest Edition.

2. Essential References

3. Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)

- Handouts and notes.

- Other reference books in thermodynamics are recommended for further readings.

4. Electronic Materials, Web Sites etc.

Website in addition to the electronic library.

5. Other learning materials such as computer-based programs/CD, professional

standards/regulations
EES software.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Lecture rooms, laboratories, etc.) Lecture rooms with smart board.
2. Computing resources
3. Other resources (specify – e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching
1. Student course evaluation survey at the conclusion of the course. 2. Class discussions about the ways to improve the course deliverables and learning outcomes at the end of the semesters. 3. Direct feed back to staff. 4. Students' society.
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Faculty assessment of the course and effectiveness of teaching delivery. • Periodic self- assessment of the general engineering courses.
3. Processes for Improvement of Teaching 1. Deanship of staff development offers workshops on improving teaching techniques. 2. State of the art teaching and learning facilities. 3. Staff gathering and feedback.
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)
5. Describe the planning arrangements for periodically reviewing course effectiveness and

planning for improvement.

- Self- assessment at every two years and the external assessment by invited faculty members at every four years will be carried out. The feedback received from these assessments will be used to plan for further improvement in the course syllabus, teaching method, and delivery of course materials.

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Basics concepts; Energy transfer; First law of thermodynamics; Second law of thermodynamics; Entropy; Carnot and reversed Carnot cycles; Rankine cycle; Vapour compression refrigeration cycles.