Course Specifications of:
Selected Topics in Thermodynamics (MEP 703)

Program(s) on which the course is given: Ph.D. in Mechanical Power Engineering
Compulsory or Elective element of program: Elective
Department offering the program: Mechanical Engineering / power
Academic year / Level: year/2014/2015
Date of specification approval: 2012

A. Basic Information

Title: Selected Topics in Thermodynamics **Code: MEP 703**
Credit Hours: 3 **Lecture: 3**
Tutorial: - **Practical: -** **Total: 3**

B- Professional Information

1- Overall aims of course:
This course helps students to:

1. Have high level of understanding on the exergy, and the exergy destruction
2. Apply an elementary treatment of the exergy analysis of a broad range of engineering applications.
3. Apply thermodynamic relation for non-measurable properties of any substance.
4. Evaluate thermodynamic properties determination.
5. Investigate thermodynamic analysis based on 1st and 2nd laws of thermodynamics for chemical reactions.
6. Demonstrate the entropy generation concept in chemical reaction and exergy destruction.

2- Intended learning outcomes of course (ILOs)

By completion of the course, the student should be able to:

2.1 Knowledge and Understanding

a1. Essential fundamentals, theories, concepts, techniques and modern knowledge of thermodynamics. (2.1.1)
a2. Basic methodologies in computational and experimental in thermodynamics research. (2.1.2).
a3. Moral and legal ethics of the professional practice in thermodynamics. (2.1.3).
a4. Advanced concepts and principles of quality of thermodynamics practice. (2.1.4).
a5. Knowledge of the effects of exercise on the environment and ways of development and conservation. (2.1.5).
a6. Knowledge of critical evaluation of the current problems related to the selected topics. (2.1.6)

2.2 Intellectual Skills

b1. Critically analyse and assess information in thermodynamic engineering and draw data analogies to solve problems, (2.2.1)
b2. Evaluate data and make sound judgments in the lack of some data to solve thermodynamic problems, (2.2.2)
b3. Plan and conduct a research study. (2.2.3)
b4. Plan for performance enhancement in thermodynamic engineering. (2.2.6)
b5. Evaluate the enhancement in the system or process performance due to the innovative part or procedure application. (2.2.8)
b6. Formulate valuable research questions in the thermodynamic. (2.2.11)

2.3 Professional and Practical Skills

c1. Write and evaluate professional thermodynamic analysis reports. (2.3.2)
c2. Assess and evaluate the implementation progress towards solving thermodynamic problems and energy systems performance. (2.3.3)
c3. Perform presentations for discussing the thermodynamics class work. (2.3.5)
c4. Produce research opportunities and use of the appropriate technological means to serve thermodynamic applications practice. (2.3.9)

2.4 General and Transferable Skills

d1. Communicate effectively using different means. (2.4.1)
d2. Use information technology in order to serve the development of professional practice. (2.4.2)
d3. Asses and identify the required learning needs. (2.4.3)
d4. Make use of the available resources of information. (2.4.4)
d5. Conduct self-learning and continuous education practices. (2.4.8)

3- Contents

No. of weeks	Topic	No. of hours
1	Reversible work and irreversibility in a closed system	3
2	Exergy analysis for a closed system	3
3	Generalized exergy analysis	3
4	Exergy efficiency and chemical exergy	3
5	Ideal gas properties	3
6	Maxwell relations	3
7	Midterm Exam.	3
8	Generalized relations	3
9	Evaluation of thermodynamic properties	3
10	Chemical reactions and combustion	3
11	First law (energy) analysis of chemical reactions	3

12	Second law (exergy) analysis of chemical reactions	3
13	Entropy generation and availability in chemical reactions	3
14	Oral Exam.	3
15	Final Exam	3

4- Course Matrix

ILO's Code Number	Teaching/Learning Methods and Strategies	Assessment Methods and Strategies
2.1.1, 2.1.2 2.1.3, 2.1.4 2.1.5, 2.1.6	Formal lectures	Individual coursework assignments, quizzes, oral discussions and reports. Mid-term and /or final written examination is given.
2.2.1, 2.2.2 2.2.3 2.2.6, 2.2.8 2.2.11	Analysis and problem-solving skills are developed through tutorial/problem sheets and small group exercises.	Analysis and problem-solving skills are assessed through oral and written examinations.
2.3.2, 2.3.3 2.3.5, 2.3.9	Simulate published papers	Coursework exercises and reports, project reports and presentations.
2.4.1, 2.4.2 2.4.3 2.4.4, 2.4.8	Those skills are not explicitly taught; however, along the course of study the student will acquire those skills to be able to perform his obligations. Attendance of seminars, workshops or conferences will help the student in developing those skills. Presentation by students (either group or individual) will train students for those skills.	Project presentation

5-Assessment schedule

Assessment 1	Assignments	on weeks	1, 3, 6
Assessment 2	Quizzes	on weeks	2, 4, 9, and 13
Assessment 3	Mid-term exam	on weeks	8
Assessment 3	Oral exam	on week	14
Assessment 4	Final exam	on week	15

6- Weighting of assessments

20% (60 marks) Home assignments, Quizzes, and reports
20% (60 marks) Mid-term examination and Oral examination
60% (180 marks) Final-term examination
100% (300 marks) Total

7- List of References

7.1 Recommended books

1- Advanced thermodynamics engineering / Kalyan Annamalai & Ishwar K. Puri. p. cm. (CRC series in computational mechanics and applied analysis)., 2002.
2- Advanced engineering thermodynamics, Adrian Bejan, Third edition, John Wiely & Sons, 2006.
3- Fundamentals of Classical Thermodynamics, Sonntag, Borgnakke and van Wylen, 6th edit, 2002.

7.2 websites

- www.4shared.com
-yahoo group mail
- www.sciencedirect.com

8- Facilities required for teaching and learning

Board and data show, computer

Course coordinator: Prof. Dr. Ramadan Y. Sakr
Course instructor: Prof. Dr. Ramadan Y. Sakr
Asso. Prof. Dr. Ragab Khalil

Head of Department: Prof. Dr. Osama Ezzat Abdel-Latif

Matrix of Course Content and ILO's

Course Title: **Selected Topics in Thermodynamics** **Code**: **MEP 703**
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Course content	ILO's A	ILO's B	ILO's C	ILO's D
Reversible work and irreversibility in a closed system	a1	b4, b5		
Exergy analysis for a closed system	a1	b4, b5		
Generalized exergy analysis	a1, a3	b3, b5, b6	c2, c4	d5
Exergy efficiency and chemical exergy	a1, a4	b4, b5	c2	
Ideal gas properties	a1	b1	c3	d1,d3
Maxwell relations	a1	b1		d4
Generalized relations	a1	b1	c2	d2
Evaluation of thermodynamic properties	a1, a2			
Chemical reactions and combustion	a1,a6	b2		
First law (energy) analysis of chemical reactions	a1, a4	b4, b5, b6	c1	
Second law (exergy) analysis of chemical reactions	a1, a3	b6	c2	d5
Entropy generation and availability in chemical reactions	a1, a3	b6		d5

Head of Department: Prof. Dr. Osama Ezzat Abdel-Latif

Matrix of Course Aims and ILO's

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1. Have high level of understanding on the exergy, and the exergy destruction	a1	b4, b5	c1	
2. Apply an elementary treatment of the exergy analysis of a broad range of engineering applications.	a1, a3	b5, b6, b4	c2, c4	
3. Apply thermodynamic relations for non-measurable properties of any substance.	a1	b1	c2,c3	
4. Evaluate thermodynamic properties determination.	a1	b1	c2	d2
5. Investigate thermodynamic analysis based on 1st and 2nd laws of thermodynamics for chemical reactions.	a1, a4	b2, b4, b5, b6	c2	
6. Demonstrate the general criterion for chemical and phase equilibrium	a1,a5	b6	c2	d5

Head of Department: Prof. Dr. Osama Ezzat Abdel-Latif