Course Specifications of: Advanced Thermodynamics MEP 605

Program(s) on which the course is given : Post Graduate **M. Eng.** 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: Advanced Thermodynamics **Code: MEP 605**
Credit Hours: 3 **Lecture: 3**
Tutorial: **Practical:** **Total: 3**

B- Professional Information

1- Overall aims of course:

This course introduces students to:

1-Understand concepts and basic principles of power plant cycles
2- Know the basis of gas power cycles
3-Understand the availability, irreversibility and thermodynamics relations
4- Solve problems on gas and gas vapor mixtures
5- Understand basics of chemical reactions and combustion

2- Intended learning outcomes of course (ILOs)

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

2.1 Knowledge and understanding

a1. Define theories, fundamentals and specialized knowledge of thermodynamics. (2.1.1)
a2. Search for scientific developments in the area of thermodynamics. (2.1.3)
a3. List ethical and legal principles of professional practice in advanced thermodynamics (2.1.4)
a4. Describe the current thermodynamic problems in critically evaluated manner. (2.1.6)

2.2 Intellectual skills

b1. Analyze and assess information in thermodynamics engineering and draw analogies to solve problems. (2.2.1)
b2. Solve problems in spite of the lack of some data.(2.2.2)
b3. Conduct a research study and/or write a scientific essay about a research problem.(2.2.4)
b4. Make professional decisions in various professional contexts.(2.2.7)
b5. Evaluate the relative enhancement in the thermodynamics process performance due to the innovative part or procedure application. (2.2.8)

2.3 Professional and practical skills

c1. Perform basic professional and modern skills in the thermodynamics engineering. (2.3.1)
c2. Write and evaluate professional reports.(2.3.2)

2.4 General and transferable skills

d1. Communicate effectively using different means. (2.4.1)
d2. Work in a group and Lead a team in familiar professional contexts. (2.4.6)
d3. Manage time effectively.(2.4.7)
d4. Conduct self-learning and continuous education practices. (2.4.8)

3- Contents

Topic No.	Topic	No. of weeks	No. of hours
1	STEAM POWER PLANTS Background, Introduction, Vapor Power Cycles Carnot Vapor Cycle, The Rankine Cycle, The Rankine Cycle Components, Effect of Pressure and TeMEPrature on Rankine Cycle, The Reheat Cycle, The Regenerative Cycle.	2	6
2	GAS POWER SYSTEMS Internal Combustion Engines Air-Standard Analysis, The air-standard Otto cycle, The air-standard Diesel Cycle, The air-standard dual cycle, Ericsson cycle, Stirling cycle, Brayton cycle. Comparison between the air-standard cycles	1	3
3	IRREVERSIBILITY AND AVAILABILITY Reversible Work, Irreversibility, Consideration Processes that Involve Heat Transfer, Available and Unavailable energies	2	6
4	Mid-Term	1	3
5	THERMODYNAMIC RELATIONS Two Important Relations, The Maxwell Relations, Clapeyron Equation, Thermodynamic Relations Involving Internal Energy and entropy	3	9
6	GAS AND GAS VAPOR MIXTURES	3	9
7	FUELS AND COMBUSTION OF FUELS The chemical reactions and combustion - fluid flow through the nozzles – chemical and phase equilibrium for ideal gas mixture during the reaction.	2	6
	Exam	1	3
	Total	15	45

4- Course Matrix

ILO's	Teaching/learning methods and strategies	Assessment methods and

code number		strategies
2.1.1 2.1.3 2.1.4 2.1.6	Formal lectures,	Individual coursework assignments, quizzes, oral discussions and reports. Mid-year and /or final written examination is given.
2.2.1 2.2.2 2.2.4 2.2.7 2.2.8	Analysis and problem-solving skills are developed through tutorial/problem sheets and small group exercises. Research skills are developed through a small subject oriented research project.	Analysis and problem- solving skills are assessed through oral and written examinations.
2.3.1 2.3.2	Experiments demonstrations, practical work,	Coursework exercises and reports, project reports and presentations.
2.4.1 2.4.6 2.4.7 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.	Project presentation

5- Assessment schedule

Assessment 1	Assignments	on weeks	2,3,4,5,7,9,11,13
Assessment 2	Quizzes	on weeks	6, 12
Assessment 3	Mid-term exam	on weeks	8
Assessment 4	Oral exam	on week	14
Assessment 5	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 Essential books (Text books)

- Van Wylen, G. Sonntag R. and Borgnakke, C. Fundamentals of Classical Thermodynamics, John Wiley & Sons, Inc. 4th edition, 2002.
- Yunus, A. C, Thermodynamics, An Engineering Approach, McGraw-Hill, third edition, 2007

7.2 Recommended books; Periodicals & Websites.

- Holman, J. P., Thermodynamics, McGraw-Hill, Inc.2008.
- Burghardt, M. D., Engineering Thermodynamics .with Applications, Harper &Row Publishers, Inc., 2nd edition, 1982.
- www.google.com/Thermodynamics
- www.4shared.com

8- Facilities required for teaching and learning

Lecture room equipped with overhead projector
Presentation board, computer and data show

Course coordinator: Prof. Dr. Eed A. Abdel-Hadi , Prof . Dr . Ahmed maged osman
Course instructor: Prof. Dr. Eed A. Abdel-Hadi , Prof . Dr . Ahmed maged osman

Head of Department Prof. Dr. Osama Ezzat Abdellatif

Matrix of course content and ILO's

Course Title: Advanced Thermodynamics **Code: MEP 605**
Lecture: 3. **Tutorial**: ---- **Practical**: ---- **Total:** 3
Program on which the course is given: Post Graduate **M. Eng.** in Power Engineering.
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Course content	ILO's A	ILO's B	ILO's C	ILO's D
1- Introduction to thermodynamic models to calculate the thermal properties	a1,a4	b1	c1	d1
2- first law of thermodynamics and its applications		b2		d2
3- second law – entropy and its applications – availability , irreversibility and its applications	a2	b4		d4
4- thermodynamic analysis of power and refrigeration cycles - heat		b5	c2	
5- pumps - exergy and its applications in energy systems	a3	b3		d3

Matrix of course aims and ILO's

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Course aims	ILO's A	ILO's B	ILO's C	ILO's D
1. Understand concepts and basic principles of thermodynamic models describing the properties of working fluid undergoing thermodynamic processes.	a1	b1	c1	d1
2. Apply 1st law of thermodynamics on a very wide range of energy conversion processes.	a1	b1,b5	c1	d1
3. Understand the physical meaning of entropy.	a4	b2		d2
4. Apply 2nd law of thermodynamics on a very wide range of energy conversion processes.	a2	b4	c2	d4
5. Understand the availability, and the irreversibility-Perform energy and exergy analysis for power and refrigeration cycles- Perform analysis of combiend cycles	a3	b3		d3