Course Specifications

University: Benha University **Faculty: High Institute of Technology**

Course specifications

Programme(s) on which the course is given	1. Mechanical Power Engineering 2. Production Engineering
Major or minor element of programmes	Major
Department offering the programme	Mechanical Engineering
Department offering the course	Mechanical Engineering
Academic year / Level	2008-2009 / Level 2 - Semester 2
Date of specification approval	June, 2009

A- Basic Information

Title: Thermodynamics **Code: M 222**

Credit Hours: **Lecture:** **4**

Tutorial: **1** **Practical:** **1** **Total:** **6**

B- Professional Information

1 - Overall aims of course

By the end of the course the students will be able to:

- ✓ Demonstrate knowledge of thermodynamics since, energy and its conservations laws, fundamentals of heat transfer.
- ✓ Demonstrate knowledge on thermodynamics properties, thermodynamics tables and charts.
- ✓ Define and solve problems in thermodynamics related to mechanical applications.
- ✓ Getting familiar with reversible and irreversible process and the concept of increasing efficiency of devices.
- ✓ Demonstrate knowledge on entropy and principle of entropy increase
- ✓ Getting familiar with thermal power stations and heat engines and how to measure performance of them.

2- Intended learning outcomes of course (ILOs)

a. Knowledge and understanding:

a.1 Define thermodynamics properties of pure substances, ideal gases and solids.

a.2 Getting familiar with table properties and properties charts of pure substances and ideal gases.

a.3 Understand thermodynamics laws for energy conservations and energy transformations.

a.4 Gaining the ability to apply energy conservations to all mechanical systems and devices.

a.5 Understand the principle of irreversibility and the idealization of thermodynamics process.

a.6 Understand the concept of thermal efficiency and coefficient of performance of engines and heat transfer devices.

a.7 Understand the concept of adiabatic efficiency of thermodynamics devices.

b. Intellectual skills

b.1 Solve basic problems for thermodynamics.

b.2 Apply energy conservations on mechanical equipment and real problems.

b.3 Estimation of thermal efficiency of different stations.

b.4 Know how to increase the adiabatic efficiency of thermodynamics devices.

c- Professional and practical skills

c.1 Use appropriate measuring parameters of system/ equipment performance

c.2 Perform energy and heat balance on systems and equipment

c.3 Verification of some basic laws such as ideal gas relations and thermodynamics law.

d- General and transferable skills

d.1 Write reports in accordance with the scientific guidelines

d.2 Present data on a scientific way

d.3 Analysis of data and problems solving

d.4 Discuss results and obtain conclusions

d.5 Work successfully as a part of a team

3- Contents

Topic	No. of Hours	Lecture	Tutorial/ Practical
Basic Concept of Thermodynamics: Thermodynamics and energy, A note on dimensions and units, closed and open system, forms of energy, properties of a system, processes and cycles, temperature and zero law of thermodynamics.	**6**	**1.5**	**3**
Properties of Pure Substances: pure substances, phases of pure substances, phase-change process, properties diagram for phase change processes, properties table, steam chart.	**6**	**1.5**	**3**
First Law of Thermodynamics for a Closed System: Heat and work, mechanical forms of work, the first law of thermodynamics undergoes a process, other forms of first law, specific heats and ideal gas thermodynamics relations.	**8**	**2**	**4**
First Law of Thermodynamics for Open System: Conservation of mass, conservation of energy, unsteady flow, steady flow, thermodynamics analysis of some steady flow devices (nozzles and diffusers, turbines and compressors, boilers and condensers, steam power stations), unsteady flow process	**12**	**3**	**6**
Second Law of Thermodynamics: Thermal energy reservoir, heat engine, second law of thermodynamics statements, refrigeration and heat pumps, reversible and irreversible process, Carnot cycle, Carnot principle, Carnot heat engine, Carnot refrigeration and heat pump.	**12**	**3**	**4**
Entropy: Clausius inequality, entropy, the increase of entropy principle, causes of entropy change, property diagram involving entropy, entropy change of pure substances, entropy change of solid and	**16**	**4**	**6**

liquid, entropy change of ideal gases, reversible steady flow work, adiabatic efficiency of some steady flow devices.			

4– Teaching and learning methods

4.1- Lectures

4.2- Tutorials and discussion sessions

4.3- Laboratories

5- Student assessment methods

5.1 Written exams	to assess the understanding of the concepts and the ability to solve problems thermodynamics.
5.2 Oral/Practical exam	to assess the skills of analysis and discussion related to thermodynamics and thermodynamics experiments,
5.3 Class work	to assess the discussion of the technical reports assignments

Assessment schedule

Assessment 1 (Written Exam)	Week 5
Assessment 2 (Written Exam)	week 10
Assessment 3 (Class Work)	weeks 1 to Week 15 (Continuous)
Oral/Practical Exam	Week 15
Assessment 4 (Final Written Exam)	week 16

Weighting of assessments

Assessment 1 (Written Exam)	6	%
Assessment 2 (Written Exam)	6	%
Assessment 3 (Class Work)	8	%
Oral/Practical Exam	20	
Final Written Exam	60	%
Total	100	%

6- List of references

6.1- Course notes

Lecture notes

6.2- Essential books (text books)

1. Thermodynamics an Engineering Approach, Yunus A. Cengel & Michael A. Boles, Second Editions, McGraw-Hill, Inc.

6.3- Recommended books

1. Fundamental of Classical Thermodynamics, G.J. Van Wylen and RE. Sonntag, 3d ed., Wiley, New York, 1985
2. Applied Thermodynamics for Engineering Technology, Fifth Edition, Eastop & McConkey, Longman

6.4- Periodicals, Web sites, … etc

7- Facilities required for teaching and learning

Teaching facilities (whiteboard, presentation board, data show)

Laboratory

Course coordinator: Dr. Sameh Nada

Head of Department: Dr. Sameh Nada

Date: / /