SYLLABUS: THERMO FLUID SCIENCE 1

Date / Revision August 22, 2017 / 22.08.17 /MaS
Faculty Engineering
Study Programm Mechatronics

SUBJECT: Thermo Fluid Science 1

1 Basic Information

1.01	**Subject Name**	**Thermo Fluid Science 1**
1.02	**Semester**	3
1.03	**Level**	1
1.04	**SKS**	2
1.05	**Mandatory / Curriculum**	Mandatory / D-02
1.06	**Subject Code**	THFL
1.07	**Subject Code**	MTE-D-THFL-3102
1.08	**Year**	2017 (7)
1.09	**Quality Control**	Final Test, see evaluation
1.10	**Limitations**	Min 12 and Max 32 students in one class
1.11	**Combined with**	AVE, MEE
1.12	**Perquisite**	Statics and Mechanics of Materials
1.13	**Responsible**	Dean of Engineering Faculty
1.14	**Revision**	22-08-2017/MaS

2 Description of Subject

This course provides an abbreviated version of standard thermodynamics, fluid mechanics, and heat transfer, covering topics that engineering students are most likely to need in their professional lives. Students in a combined thermal-fluids course can gain a basic understanding of energy and energy interactions, various mechanisms of heat transfer, and fundamentals of fluid flow

3 Objectives

- Introduces the concept of thermodynamics

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- introduce the first – and second- low of thermodynamic
- introduce the use of thermodynamics first- and second-law.

4 Competency

After having the course, students are expected have to:

- understand concepts and definitions of thermodynamics.
- identify properties of a pure substance.
- understand about work and heat.
- describe about the first law of thermodynamics.
- understand about first law analysis for a control volume.
- understand about material removal processes.
- describe the second law of thermodynamics.
- understand about entropy.
- understand about second law analysis for a control volume.

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Tutorial/ Practice Classes: preview of materials, revision;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

6 Evaluation

5.1	**Absence maximum**	25%
5.2	**Participation in Discussion**	05 Points
5.3	**Homework / Classwork**	05 Points
5.4	**Presentation /Simulation**	10 Poins
5.5	**Daily Quiz**	20 Points
5.6	**Final Examination**	60 Points
	Total	100 Points

7 Text Book and Reference

1	**Main Text Book:** "Fundamentals of Thermal Fluid Sciences (SI Units), 4th Edition, 2012", Authors: Yunus Cengel, Robert Turner, John Cimbala, Publisher: Mc-GrawHill.
2	**Supplementary Text books:** •

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8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1	**Introduction and Overview:** Introduction to Thermal-Fluid Sciences; Thermodynamics; Heat Transfer; Fluid Mechanics; Importance of Dimensions and Units; Problem-Solving Technique.	Ch1 [1]	
2	**Basic Concepts of Thermodynamics:** Systems and Control Volumes; Properties of a System; Density and Specific Gravity; State and Equilibrium; Processes and Cycles; Temperature and the Zeroth Law of Thermodynamics; Pressure; The Manometer; The Barometer and Atmospheric Pressure.	Ch2[1]	
3	**Energy, Energy Transfer, and General Energy Analysis:** Introduction; Forms of Energy; Energy Transfer by Heat; Energy Transfer by Work; Mechanical Forms of Work; The First Law of Thermodynamics; Energy Conversion Efficiencies.	Ch3[1]	
4	**Properties of Pure Substances:** Pure Substance; Phases of a Pure Substance; Phase-Change Processes of Pure Substances; Property Diagrams for Phase-Change Processes; Property Tables; The Ideal-Gas Equation of State; Compressibility Factor—A Measure of Deviation From Ideal-Gas Behavior.	Ch4[1]	
5	**Energy Analysis of Closed Systems:** Moving Boundary Work; Energy Balance for Closed Systems; Specific Heats; Internal Energy, Enthalpy, and Specific Heats of Ideal Gases; Internal Energy, Enthalpy, and Specific Heats of Solids and Liquids.	Ch5[1]	
6	**Mass and Energy Analysis of Control Volumes:** Conservation of Mass; Flow Work and the Energy of a Flowing Fluid; Energy Analysis of Steady-Flow Systems; Some Steady-Flow Engineering Devices; Energy Analysis of Unsteady-Flow Processes.	Ch6[1]	
7	**The Second Law of Thermodynamics:** Introduction to the Second Law; Thermal Energy Reservoirs; Heat Engines; Refrigerators and Heat Pumps; Reversible and Irreversible Processes; The Carnot Cycle; The Carnot Principles;	Ch7[1]	
8	**MIDTERM SEMESTER BREAK**		
9	**The Second Law of Thermodynamics:** The Carnot Cycle; The Carnot Principles; The Thermodynamic Temperature Scale; The Carnot Heat Engine; The Carnot Refrigerator and Heat Pump.	Ch7[1]	

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10,11	**Entropy:** Entropy; The Increase of Entropy Principle; Entropy Change of Pure Substances; Isentropic Processes; Property Diagrams Involving Entropy; What is Entropy?; The *T ds* Relations; Entropy Change of Liquids and Solids; The Entropy Change of Ideal Gases; Reversible Steady-Flow Work; Isentropic Efficiencies of Steady- Flow Devices; Entropy Balance.	Ch8[1]	
12-14	**Power and Refrigeration Cycles:** Basic Considerations in The Analysis of Power Cycles; The Carnot Cycle and its Value in Engineering; Air-Standard Assumptions; An Overview of Reciprocating Engines; Otto Cycle: The Ideal Cycle for Spark-Ignition Engines; Diesel Cycle: The Ideal Cycle for Compression-Ignition Engines; Brayton Cycle: The Ideal Cycle for Gas-Turbine Engines; The Brayton Cycle with Regeneration; The Carnot Vapor Cycle; Rankine Cycle: The Ideal Cycle for Vapor Power Cycles; Deviation of Actual Vapor Power Cycles from Idealized Ones; How Can We Increase The Efficiency of The Rankine Cycle?; The Ideal Reheat Rankine Cycle; Refrigerators and Heat Pumps; The Reversed Carnot Cycle; The Ideal Vapor-Compression Refrigeration Cycle; Actual Vapor-Compression Refrigeration Cycle.	Ch9[1]	
15	**Rehearsal and Tutorial:** Rehearsal of all subject and students can ask for more detail.		
16	**Final Examination**		

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