SYLLABUS: THERMO FLUID SCIENCE 2

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

SUBJECT: Thermo Fluid Science 2

1 Basic Information

1.01	**Subject Name**	**Thermo Fluid Science 2**
1.02	**Semester**	4
1.03	**Level**	2
1.04	**SKS**	2
1.05	**Mandatory / Curriculum**	Mandatory / D-02
1.06	**Subject Code**	THFL
1.07	**Subject Code**	MTE-D-4202
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 irreversibility and availability.
- Understand about power and refrigerator systems.
- Describe about gas mixture.
- Understand about thermodynamic relations.
- Understand about chemical reactions.
- Introduce to phase and chemical equilibrium.
- Understand about compressibility flow.

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Discussion, sample problem, group work;
- 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:** •

8 Content / Topics of Lecture

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Week	Content/ Topics of Lecturing	Text Book	Remark
1	**Introduction and Properties of Fluids:** The No-Slip Condition; Classification of Fluid Flows; Vapor Pressure and Cavitation; Viscosity; Surface Tension and Capillary Effect;	Ch10[1]	
2	**Fluid Statics:** Introduction to Fluid Statics; Hydrostatic Forces on Submerged Plane Surfaces; Hydrostatic Forces on Submerged Curved Surfaces; Buoyancy and Stability.	Ch11[1]	
3	**Bernoulli and Energy Equations:** The Bernoulli Equation; General Energy Equation; Energy Analysis of Steady Flows.	Ch12[1]	
4	**Momentum Analysis of Flow Systems:** Newton's Laws; Choosing a Control Volume; Forces Acting on a Control Volume; The Reynolds Transport Theorem; The Linear Momentum Equation.	Ch13[1]	
5	**Internal Flow:** Introduction; Laminar and Turbulent Flows; The Entrance Region; Laminar Flow in Pipes; Turbulent Flow in Pipes; Minor Losses; Piping Networks and Pump Selection.	Ch14[1]	
6	**External Flow: Drag and Lift:** Introduction; Drag and Lift; Friction and Pressure Drag; Drag Coefficients of Common Geometries; Parallel Flow Over Flat Plates; Flow Over Cylinders and Spheres; Lift.	Ch15[1]	
7	**Mechanisms of Heat Transfer:** Introduction; Conduction; Convection; Radiation; Simultaneous Heat Transfer Mechanisms.	Ch16[1]	
8	**MIDTERM SEMESTER BREAK**		
9	**Steady Heat Conduction:** Steady Heat Conduction in Plane Walls; Thermal Contact Resistance; Generalized Thermal Resistance Networks; Heat Conduction in Cylinders and Spheres; Critical Radius of Insulation; Heat Transfer From Finned Surfaces.	Ch17[1]	
10	**Transient Heat Conduction:** Lumped System Analysis; Transient Heat Conduction in Large Plane Walls, Long Cylinders, and Spheres with Spatial Effects; Transient Heat Conduction in Semi-Infinite Solids; Transient Heat Conduction in Multidimensional Systems	Ch18[1]	
11	**Forced Convection:** Physical Mechanism of Convection; Thermal Boundary Layer; Parallel Flow Over Flat Plates; Flow Across Cylinders and Spheres; General Considerations for Pipe Flow; General Thermal Analysis; Laminar Flow in Tubes; Turbulent Flow in Tubes.	Ch19[1]	
12	**Natural Convection:** Physical Mechanism of Natural Convection; Equation of Motion and the Grashof Number; Natural Convection Over Surfaces; Natural Convection Inside Enclosures.	Ch20[1]	

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13	**Radiation Heat Transfer:** Introduction; Thermal Radiation; Blackbody Radiation; Radiative Properties; The View Factor; Radiation Heat Transfer: Black Surfaces; Radiation Heat Transfer: Diffuse, Gray Surfaces.	Ch21[1]	
14	**Heat Exchangers:** Types of Heat Exchangers; The Overall Heat Transfer Coefficient; Analysis of Heat Exchangers; The Log Mean Temperature Difference Method; The Effectiveness–NTU Method.	Ch22[1]	
15	**Rehearsal and Tutorial:** Rehearsal of all subject and students can ask for more detail.		
16	**Final Examination**		

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