AERO 205 - THERMODYNAMICS

Course Code	Course Name	Semester	
AERO 205	Thermodynamics	Fall ☒ Spring ☐ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	5
3	0 / 0		

Course Details	
Department	Aerospace Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	To address the basic principles of thermodynamics and give an idea about its use in engineering applications with real-life examples.
Course Content	Basic Concepts; System, surroundings, properties (extensive/intensive), state, process, equilibrium. Properties of Pure Substances; Phases, phase diagrams,property tables (steam/refrigerants). Ideal and Real Gases. Energy; Work and heat. Properties of Pure Substances Phases, phase diagrams, property tables (steam/refrigerants). First Law of Thermodynamics; Energy conservation for closed and open systems (steady-flow systems). Second Law of Thermodynamics; Heat engines, entropy, reversible/irreversible processes. Entropy; Definition and calculation of entropy changes. Thermodynamic Cycles; Power Cycles: Overview of Otto, Diesel, and Rankine cycles. Refrigeration Cycles: Understanding vapor-compression cycles.
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☐ Discussion ☒
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

- Thermodynamics by YA. Çengel.
- Fundamentals of Classical Thermodynamics, by R. Sonntag, C. Borgnakkeand G. Van Wylen.

Course Category				
Mathematics and Basic Sciences	☐		Education	☐
Engineering	☒		Science	☐
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule		
No	**Topics**	**Materials/Notes**
1	Introduction	Study basic concepts of thermodynamics and energy, systems and control volumes, phase changes and cycles.
2	Energy Conversion	Heat and energy transfer, work and energy transfer, the first law of thermodynamics.
3	Properties of pure substances	Phase change processes, compressed liquid, saturated liquid, saturated steam, superheated steam, saturation temperature and saturation pressure.
4	Property of phase change	Process diagrams, tables of thermodynamic properties, enthalpy, ideal gas equation of state.
5	Closed systems energy analysis	Moving boundary work, energy balance, specific heats.
6	Perfect gases	Internal energy, enthalpy and specific heat, solids and liquids, internal energy, enthalpy and specific heat.
7	Mass and energy analysis for control volumes	The principle of conservation of mass, energy of heat and fluid flow.
8	Midterm Exam	
9	Energy analysis of open systems.	Energy analysis of continuous-flow open systems.
10	Steady-Flow Systems	Study of Some Steady-Flow Systems.
11	Second Law of Thermodynamics	Reversible and irreversible processes, Carnot cycle, Carnot Cycle applications.
12	Entropy	Defining entropy, developing entropy change relations, and deriving the increase of entropy principle.
13	Thermodynamics Cycles	Carnot Vapor Cycle, Rankine Cycle, Reheat Cycle, Combined Gas-Steam Power Cycle.
14	Air-Standard Diesel Cycle	Brayton Cycle, Vapor and Combined Power Cycles; Carnot Vapor Cycle, Rankine Cycle, Reheat Cycle, Combined Gas-Steam Power Cycle.
15	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance	14	5%
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize	5	25%
Homework		
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam	1	30%
Final Exam	1	40%
	Total	**100%**
Contribution of Midterm Studies to Success Grade		60%
Contribution of End of Semester Studies to Success Grade		40%
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	4	56
Quiz/Studio/Criticize	5	2	10
Homework			
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm			
Final Exam and Preparation for Final Exam	1	15	15
Total Workload			**123**
Total Workload / 25			**4.92**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Understand fundamental thermodynamic concepts such as open, closed, and isolated systems, the state of a system in equilibrium, and extensive and intensive properties.
L2	Understand properties of pure substances, phase diagrams and phase transitions.
L3	Understand the energy transfer by heat and work.
L4	Be acquainted with energy conservation (First Law of Thermodynamics), increased entropy (Second Law of Thermodynamics) and energy conversion.
L5	Be familiar with energy conversion devices and machines such as compressors, turbines, boilers, heat exchangers, combustion chambers, etc. and their energy balance analysis.
L6	Study thermodynamic cycles and conduct their thermodynamic analysis.

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**					**Total**
L1	4	5	5	5	1	5	3	3	2	1	1					35/55; 63.636%
L2	4	5	5	5	1	5	3	3	2	1	1					35/55; 63.636%
L3	4	5	5	5	1	5	3	3	2	1	1					35/55; 63.636%
L4	4	5	5	5	1	5	3	3	2	1	1					35/55; 63.636%
L5	4	5	5	5	1	5	3	3	2	1	1					35/55; 63.636%
L6	4	5	5	5	1	5	3	3	2	1	1					35/55; 63.636%
															Total	210/330; 63.636%