The University of Jordan
School of Engineering

Department	Course Name	Course Number	Semester
Mechanical Engineering	Thermal and Fluid Sciences	0904248	

2019 Course Catalog Description

Introduction. Basic principles of thermodynamics, fluid mechanics and heat transfer. Thermodynamics concepts and definitions. Properties of pure substances, First law of thermodynamics. System and control volume analyses. Second law of thermodynamics. Basic principles of fluid mechanics. Fluid statics. Conservation laws. Energy equations. Flow in pipes. Heat transfer modes. Conduction, convection and radiation.

Instructors

Name	E-mail	Sec	Office Hours		Lecture Time	
			Tue	Mon/ Wed	Sun /Tue/ Thu	Mon/ Wed

Text Books

	Text book 1	Text book 2
Title	Fundamentals of Thermal-Fluid Sciences	Class handouts
Author(s)	Y. A. Cengel, J. M. Cimbala and R. H. Turner	
Publisher, Year, Edition	McGraw Hill, 2017, 5th Ed., SI Units	

References

Books	1. Sonntag, Borgnakke, and Van Wylen, "Fundamentals of Thermodynamics", 5th ed., John Wiley and Sons, Inc., 2005. 2. Roberson, and Crowe, "Engineering Fluid Mechanics", 6th ed., John Wiley and Sons, Inc., 1997. 3. Incropera, and DeWitt, "Heat and Mass Transfer", 4th ed., John Wiley and Sons, Inc., 1996.
Journals	
Internet links	

Prerequisites

Prerequisites by topic	
Prerequisites by course	0302102
Co-requisites by course	
Prerequisite for	

Topics Covered

Week	Topics	Chapter in Text	Sections
1	• General introduction to class three subjects (Thermodynamic, fluid mechanics, and heat transfer)	1	1-1 - 1-6
2	• Specific introduction to Thermodynamic concepts and definitions.	2	2-1 – 2-7
3	• Introduction to energy and concept of conservation of energy in physical sense. Mechanisms of energy transfer by mass, work, and heat.	3	3-1 – 3-7

4	• Properties of pure substance and thermodynamic properties, problem solving.	4	4-1 – 4-7
5	• First law of thermodynamic: Closed system.	5	5-1 – 5-5
6	• First law of thermodynamic: Open system.	6	6-1 – 6-4
7	• Second Law of Thermodynamic, Carnot heat engine, refrigerators, heat pumps, reversible process.	7	7-1 – 7-10
8	• Pressure, manometers and Barometers. Introduction to Fluid statics, pressure variation with depth, calculation of hydrostatic force and line of action on submerged surfaces.	2, 11	2-7, 2-8, 11-1 – 11-3
9	• Efficiencies, Energy equation for flowing fluid, Bernoulli equation, and energy analysis of steady flows.	3, 12	3-7, 12-1 & 12-2
10	• Flow in a conduit, entrance length, fully developed flow, major and minor losses and piping system.	14	14-1 – 14-7
11	• Mechanisms of heat transfer: Conduction, convection, and radiation and simultaneous heat transfer mechanisms.	16	16-1 – 16-5
12	• Steady Heat Conduction, concept of thermal network, analogy to electrical resistance.	17	17-1 – 17-3
13	• Transient heat conduction, Lumped capacitance method.	18	18-1

Mapping of Course Outcomes to ABET Student Outcomes

SOs	Course Outcomes
1	1. Understand the concept of thermodynamic properties tables and use them to define the state of the material under investigation. 2. Understand the concept of open and closed thermodynamic systems. 3. Understand conservation laws of energy and mass apply them to open, and closed thermodynamic systems. 4. Understand the physical significance of first and second Laws of thermodynamics and apply them on engineering devices and machines. 5. Understand the physical and mathematical significance of flow in a conduit. 6. Understand the three mechanisms of heat transfer between two objects (conduction, convection, and radiation) and be able to identify each of them. 7. Apply the concept of Carnot heat engine, refrigerator, and heat pump. In addition, to be able to link them directly to engineering problems. 8. Ability to apply the concept of hydrostatic pressure and force and learn how to calculate them on submerged plane objects. Understand the concepts of fluid flow, energy losses, major and minor losses during flow in a conduit, Reynolds number. 9. Understand the steady heat conduction, concept of thermal network and analogy between thermal circuits and electrical circuits. 10. Understand the transient heat conduction, lumped capacitance method and its applications 11. Understand the concept of thermodynamic properties tables and use them to define the state of the material under investigation.

Evaluation

Assessment Tools	Expected Due Date	Weight
Midterm Exam		25 %
Assignments		25 %
Final Exam		50 %

Contribution of Course to Meet the Professional Components

Relationship to Student Outcomes							
SOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Availability	X						

Relationship to Mechanical Engineering Program Objectives (MEPOs)				
MEPO1	**MEPO2**	**MEPO3**	**MEPO4**	**MEPO5**

ABET Student Outcomes (SOs)	
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	An ability to communicate effectively with a range of audiences
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated by ABET Committee, 2024