The Hashemite University
Faculty of Engineering
Course Syllabus
Department of Mechanical Engineering

Course Title:	Thermal-Fluid (3,0, 0)	**Course Number:**	110402481
Designation:	Compulsory	**Prerequisite(s):**	110406260,110102101
Instructor:	Eng.Ahmad bani yaseen	**Email:**	ahmadi_ah@hu.edu.jo
Office Hours:	By appointment.		
Required Course:	3 hours lectures per week		

Course Description : Basic concepts of thermodynamics, properties of pure substances, 1st and 2nd laws of thermodynamics, basic principles of fluid mechanics including fluid static and in motion, mass, momentum and energy conservation laws, internal flow in pipes, basic principles of heat transfer including modes of heat transfer, steady heat transfer.

Textbook(s) and/or Other Supplementary Materials:

Fundamentals of Thermal-Fluid Sciences, By Yunus A. Cengel, John M. Cimbala, Robert H. Turner, McGraw-Hill, Fifth Edition.

Major Topics Covered:

Topic	# Weeks	# Contact hours*
Basic concepts of thermodynamics, properties of pure substances	4	12
1st and 2nd laws of thermodynamics	6	18
Basic principles of fluid mechanics including fluid static and in motion, mass, momentum and energy conservation laws, internal flow in pipes	3	9
Basic principles of heat transfer including modes of heat transfer, steady heat transfer.	2	6
Total	**15**	**45**

*Contact hours include lectures only.

Specific Outcomes of Instruction (Course Learning Outcomes):

After completing the course, the student will be able to:

- Understand the process of phase changing of pure substances and using the steam tables to evaluate the sensible and latent heat for phase changing.(a),(e)
- Deal with principle of the first law of thermodynamics (energy conservation and transformation).(a),(e),(k)
- Understand the Principle of the second law and the concept of thermal efficiency for the heat engines and the coefficient of performance for the heat pumps and refrigerators.(a),(e),(k)
- Be familiar with the concept of Entropy and Carnot cycle and Carnot efficiency.(a),(e)
- Understand the principle of hydrostatic forces of liquid on submerged planes and gates.(a),(e)
- Acquire the ability to calculate the fluid flow rate and velocity in pipes.(a),(e)
- Understanding the measurements principles of fluid flow rate and its velocity.(a),(e)
- Understanding the modes of heat transfer phenomena (conduction, convection and radiation) and its application in order to calculate the heat flow rates for various systems.(a),(e),(k)

Grading Plan:

Midterm Exam : 30 points
Quizzes& Assignments: 30 points
Final Exam: 40 points

Student Outcomes (SO) Addressed by the Course:

#	Outcome Description	Contribution
General Engineering Student Outcomes		
(a)	an ability to apply knowledge of mathematics, science, and engineering	H
(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	
(c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
(d)	an ability to function on multidisciplinary teams	
(e)	an ability to identify, formulate, and solve engineering problems	H
(f)	an understanding of professional and ethical responsibility	
(g)	an ability to communicate effectively	
(h)	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i)	a recognition of the need for, and an ability to engage in life-long learning	
(j)	a knowledge of contemporary issues	
(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	H
H=High, **M**= Medium, **L**=Low		

Prepared by: Eng. Ahmad Bani yaseen **Date:** 7/10/2020

Course Content:

Chapter	**1**	**Introduction and Overview**	
	1-1	Introduction to Thermal-fluid Sciences	
	1-2	Thermodynamics	
	1-3	Heat Transfer	1
	1-4	Fluid Mechanics	
	1-5	Importance of Dimensions and units	
Chapter	**2**	**Basic Concepts of Thermodynamics**	
	2-1	Systems and control Volumes	
	2-2	Properties of a System	
	2-3	Density and Specific Gravity	
	2-4	State and Equilibrium	3
	2-5	Processes and Cycles	
	2-6	Temperature and Zeroth Law of Thermodynamics	
	2-7	Pressure	
	2-8	Pressure Measurement Devices	
Chapter	**3**	**Energy, Energy Transfer & General Energy Analysis**	
	3-1	Introduction	
	3-2	Forms of Energy	
	3-3	Energy Transfer by Heat	
	3-4	Energy Transfer by Work	4
	3-5	Mechanical Forms of Work	
	3-6	First Law of Thermodynamics	
	3-7	Energy Conversion Efficiencies	
Chapter	**4**	**Properties of Pure Substances**	
	4-1	Pure Substance	
	4-2	Phases of a Pure substance	
	4-3	Phase- Change Processes of Pure Substances	
	4-4	Property Diagrams for Phase-change Processes	4
	4-5	Property Tables	
	4-6	The Ideal-Gas Equation of state	
	4-7	Compressibility Factor	
Chapter	**5**	**Energy Analysis of Closed Systems**	
	5-1	Moving Boundary Work	
	5-2	Energy Balance for Closed Systems	
	5-3	Specific Heats	5
	5-4	Internal Energy, Enthalpy, and Specific Heats of Ideal Gases	
	5-5	Internal Energy, Enthalpy, and Specific Heat of Solids & Liquid	
Chapter	**6**	**Mass & Energy Analysis of Control Volumes**	
	6-1	Conservation of Mass	
	6-2	Flow Work and the Energy of a Flowing Fluid	4
	6-3	Energy Analysis of Steady-Flow Systems	
	6-4	Some Steady-Flow Engineering Devices	
Chapter	**7**	**The Second Law of Thermodynamics**	
	7-1	Introduction to the Second Law	
	7-2	Thermal Energy Reservoirs	
	7-3	Heat Engines	4
	7-4	Refrigerators and Heat Pumps	
	7-5	Reversible and Irreversible Processes	
	7-6	The Carnot Cycle	
	7-7	The Carnot Principles	

	7-8	The Thermodynamic Temperature Scale	
	7-9	The Carnot Heat Engine	
	7-10	The Carnot Refrigerator and Heat Pump	
Chapter	**11**	**Fluid Statics**	
	11-1	Introduction to Fluid Statics	3
	11-2	Hydrostatic Forces on Submerged Plane Surfaces	
Chapter	**12**	Bernoulli and Energy Equation	
	12-1	The Bernoulli Equation	3
	12-2	Energy Analysis of Steady Flows	
Chapter	**14**	**Internal Flow**	
	14-1	Introduction	
	14-2	Laminar and Turbulent Flows	
	14-3	The Entrance Region	
	14-4	Laminar Flow in Pipes	4
	14-5	Turbulent Flow in Pipes	
	14-6	Minor Losses	
	14-7	Piping Networks and Pump Selection	
Chapter	**16**	**Mechanisms of Heat Transfer**	
	16-1	Introduction	
	16-2	Conduction	
	16-3	Convection	3
	16-4	Radiation	
	16-5	Simultaneous Heat Transfer Mechanisms	
Chapter	**17**	**Steady Heat Conduction**	
	17-1	Steady Heat Conduction in Plane Walls	
	17-2	Thermal Contact Resistance	3
	17-3	Generalized Thermal Resistance Networks	