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

Course Title:	**Thermal Science Lab (1)**	**Course Number:**	110402426
Designation:	Compulsory	**Prerequisite(s):**	110402324 & 110402325
Instructor:	Eng. Ahmad Bani yaseen		
Instructor's e-mail:	ahmadi_ah@hu.edu.jo		
Office Hours:	by appointment		

Course Description (catalog): Conduct experiments in teams, analyze data, and communicate experimental results in written technical reports in order to improve student knowledge and understand of basic concepts of thermodynamics and heat transfer. Experiments done on equipment such as: Marcet boiler apparatus, Gas calorific value apparatus, Nozzle, compressors, the thermal conductivity of building and insulating materials unit, refrigeration cycle apparatus and heat exchangers.

Textbook(s) and/or Other Supplementary Materials:
Thermal science –I laboratory Manual, Dept. of Mechanical engineering, The Hashemite University.

References:
1. Thermodynamics, an Engineering Approach, 8th edition , Yunus A. Cengel, and Michael A. Boles,
2. Fundamentals of Heat and Mass Transfer, F.P. Incropera, D.P. DeWitt, T.L. Bergman, and A.S. Lavine, 7th Edition (John Wiley & Sons)
3. "Engineering Fundamentals of the Internal Combustion Engine" by W. Pulkrabek, Pearson Prentice Hall, 2nd Int. edition, 2004.

Major Topics Covered:

Topic	# Weeks	# Contact hours*
Introduction to the lab [Lab policy, Equipment, Experiments, and safety]	1	3
Experiment 1: Marcet boiler	1	3
Experiment 2: Gas calorific value	1	3
Experiment 3: Nozzle Test	1	3
Experiment 4: Refrigeration cycle	1	3
Experiment 5: Two stage piston type air compressor	1	3
MID EXAM Material included[Exp. 1, 2, 3,4 and 5]	1	3
Experiment 6: Thermal Resistance of Multilayer Insulation Material	1	3
Experiment 7: Double pipe concentric tube heat exchanger	1	3
Experiment 8: Cross flow heat exchanger	1	3
Experiment 9: Combined convection &radiation	1	3
Experiment 10: Forced convection & radiation		
Total	**15**	**45**

*Contact hours include lectures, labs, and tutorials.

Specific Outcomes of Instruction (Course Learning Outcomes):

A student who successfully fulfills the course requirements will be able to:

1. Investigate the relationship between (pressure) and (temperature) of a saturated steam, in equilibrium with (water). **[a,b,d,i]**
2. Determine the calorific value of a gaseous fuel.
3. To study pressure and velocity distribution along a nozzle and to find critical pressure ratio and efficiency of a nozzle. **[a,b,d,i]**
4. Find the coefficient of performance of a refrigeration cycle. **[a,b,d,i]**
5. Determine the polytropic index (n), for the compressor, calculate the isothermal and polytropic work, as well as the isothermal efficiency. **[a,b,d,i]**
6. Determine thermal resistance of multilayer insulation materials. **[a,b,d,i]**
7. Study the performance and the characteristics of double pipe, water to water, concentric tube heat exchanger in both parallel and counter flow. **[a,b,d,i]**
8. Study the steady state heat transfer, and to determine the surface heat transfer coefficient for a single tube in a transverse flow air stream. **[a,b,d,i]**
9. Determine the combined heat transfer (radiation convection) from a horizontal cylinder in natural convection over a wide range of power inputs and corresponding surface temperatures. and to demonstrate the relationship between power input and surface temperature in Free convection. **[a,b,d,i]**
10. To determine the effect of force convection on heat transfer from the surface of a cylinder at varying air velocities and surface temperatures and to demonstrate the relationship between air velocity and surface temperature for a cylinder subject to forced convection. **[a,b,d,i]**

Student Outcomes (SO) Addressed by the Course:

#	Outcome Description	Contribution
	General Engineering Student Outcomes	
(a)	Ability to apply mathematics, science and engineering principles.	L
(b)	Ability to design and conduct experiments, analyze and interpret data.	H
(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)	Ability to function on multidisciplinary teams.	L
(e)	Ability to identify, formulate and solve engineering problems.	L
(f)	Understanding of professional and ethical responsibility.	
(g)	Ability to communicate effectively.	M
(h)	The broad education necessary to understand the impact of engineering solutions in a global and societal context.	
(i)	Recognition of the need for and an ability to engage in life-long learning.	
(j)	Knowledge of contemporary issues.	
(k)	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	

H=High, **M**= Medium, **L**=Low

Grading Plan:

Mid Exam: (25 points)
Reports: (35 points)
Final Exam :(40 points)