هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Thermodynamics-I
Course Code:	221-MEC-3
Program:	Bachelor of Science in Engineering
Department:	Mechanical Engineering
College:	College of Engineering
Institution:	Najran University
Version:	1.0
Last Revision Date:	02/28/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:3					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Third Year \ Level 5					
4. Course general Description:					
Properties of a System, Thermal Equilibrium, Zeroth Law of Thermodynamics, Work and Displacement in various Quasi State Systems, First Law of Thermodynamics and its application to non-cyclic Processes, First Law for Control Volumes, Steady Flow Energy Equations. Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equality, Reversible and Irreversible Processes, Entropy: Its Physical Interpretation, Corollaries of Second Law. Combined First & Second Laws Equations, Entropy through TDS Relations, Maxwell's Relations, Clausius Inequality, Carnot Cycle, and Thermodynamics Temperature Scale. Properties of Pure Substances, Use of Steam Tables and Mollier Diagram, Ideal gas and Properties. Real Gas, Equations of State, Vander Walls' Equation, Compressibility Factor, Power Cycles					
5. Pre-requirements for this course (if any)**:**					
203-MATH-3(Advanced Calculus)					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
1. Identify the basic thermal properties of a system. 2. Understand and evaluate different laws of thermodynamics. 3. Identify the different thermodynamic cycles and their relations. 4. Use the steam table, and diagrams, and estimate different values of a thermodynamic system. 5. Differentiate between Ideal and real gas properties, their governing equations, and applications in power cycles.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	15
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Identify the ideal gas model for thermodynamic analysis.**	**1**	**TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each**	**Test performance evaluation -Evaluation of participation in discussion and group assignments**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			chapter with the CLO. TS:4 – Conducting quizzes through each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
1.2	Understand key concepts related to the second law of thermodynamics.	7	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Giving more assignment through each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Test performance evaluation -Evaluation of participation in discussion and group assignments
...				
2.0	**Skills**			
2.1	Apply closed system energy balances, to model closed systems.	2	TS:1-Interactive lectures using PowerPoint slides	Locally Developed Exams such as Quiz, Mid &

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes through each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students	Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
2.2	Analyze the Carnot cycle, assess the performance of power cycles and refrigeration and heat pump cycles.	6	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes through each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
...				

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	Values, autonomy, and responsibility			
3.1	Perform air-stand analyses of internal combustion engines based on the Otto, Diesel, and Perform air-standard analyses of gas turbine power plants based on the Brayton cycle.ard	5	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting midterm and Final Exam through each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours.	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes ped
3.2	Develop and analyze thermodynamic models of vapor power plants based on the Rankine cycle.	4	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting midterm and Final Exam through each chapter	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
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C. Course Content

No	List of Topics	Contact Hours
1.	Concepts and definitions	8
2.	Properties of pure substances	8
3.	Different forms of energy	8
4.	Concepts of energy, heat and work	8
5.	First law of thermodynamics	8
6.	Properties of pure substances and evaluating properties	6
7.	Applications of first law on closed system and control volume	6
8.	Second law of thermodynamics	8
	Total	60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	1-10	10%
2.	Quizzes	3 & 7	10%
3.	Mid-term	4 & 8	20%
4.	labs	1-10	10%
5.	Final exam	15	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Fundamentals of Classical Thermodynamics by G. J. Van Wylen and R. E. Sonntag, John Wiley & Sons Publications, 1966

Supportive References	**Engineering Thermodynamics by P. K. Nag, Tata McGraw Hill Publications,2013 " Fundamentals of Engineering Thermodynamics, 8e, Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey , Wiley, 2014**
Electronic Materials	**Online custom books**
Other Learning Materials	**NA**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms and laboratories**
Technology equipment (projector, smart board, software)	**--**
Other equipment (depending on the nature of the specialty)	**--**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program Leaders and Peer Reviewer	Direct, Indirect
Effectiveness of Students assessment	Students & Faculty	Direct and Indirect
Quality of learning resources	Students & Faculty	Direct and Indirect
The extent to which CLOs have been achieved	Students & Faculty	Direct and Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTMENT OF MECHANICAL ENGINEERING**
REFERENCE NO.	
DATE	**02/27/2024**