Course Specification

Course Title: Applied Thermodynamics
Course Code: 232MMET
Program: Mechanical Maintenance Engineering Technology
Department: Mechanical Engineering Technology
College: College of Applied Industrial Technology
Institution: Jazan University
Version: V2022
Last Revision Date : 12-03-2023

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	2CR hours				
2. Course type					
a.	University ☐	College ☐	Department √	Track☐	Others☐
b.	Required √	Elective☐			
3. Level/year at which this course is offered: Fourth level/ 2nd Year					
4. Course general Description This is an introductory course which provides the basic theoretical and practical skills in applied thermodynamics. The course contents may include definition of basic terms used in thermodynamics, sources of energy, energy equations with their applications, and principle stages, working principles, construction, and performance testing of internal combustion engines with applications and testing. It includes basics of Refrigeration and Air-conditioning and their major components of evaporator, compressor, condenser and expansion devices. The course also may provide estimation of work and heat transfers during thermodynamic processes and deals with types, applications, construction, working principles, operation and performance testing of gas turbines, boilers and steam turbines, and basic principles of refrigeration and air conditioning system They are: 2 classes (1 hour) for the theoretical part and 2 hours' class for laboratory for which students apply and implement the concepts of the lectures. The laboratory classes also includes the maintenance procedure of Air-conditioner and Refrigerator, leak testing, vacuuming and charging of refrigerant, and determination of COP of simple vapour compression refrigeration cycle					
5. Pre-requirements for this course (if any): 191PHYS (Physics)					
6. Co- requirements for this course (if any): Nil					
7. Course Main Objective(s) This course offers an introduction to the principles of operation, configuration, characteristics and key implementation issues of various types of thermodynamics laws and their applications, working principles of Refrigeration and Air conditioning and Heat Pump. The course is of particular interest to technicians employed in the field of mechanical engineering technology.					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	33	100
2.	E-learning		
3.	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	11
2.	Laboratory/Studio	22
3.	Field	---
4.	Tutorial	---
5.	Others (specify)	---
	Total	33

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	Explain the basic concepts, definition and different engineering thermodynamics systems, Refrigeration, and Air-Conditioning, Heat Pump	K1.2	Lecture, active learning, discussion	Quizzes, Assignments, tutorials & exams
1.2				
…				
2.0	Skills			
2.1	Categorize the three basic laws of thermodynamics (Zeroth, First, and Second), and types of energy and apply the principles for functioning	S1.3	Lecture, active learning, discussion	Quizzes, Assignments, tutorials & exams
2.2	Develop a mass and energy flow of control volumes of a closed system & apply it to boiler,	S2.1	Lecture, active learning,	Quizzes, Assignments, tutorials &

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	condenser, evaporator, nozzles, diffusers, turbines, compressors and fans		discussion	exams
2.3	Evaluate the standard experiment and measure the data to analyze and interpret the results of the efficiency and coefficient of performance of heat engine, heat pump, refrigerator, Carnot cycle, simple vapour compression refrigeration cycle and split air conditioner	S4.2	Lecture, active learning, discussion, Practical class	Quizzes, Assignments, tutorials & exams, Lab training and lab exam
2.4	Apply the rules and principles to define the change in state, cycle and various process of the system and properties of pure substances	S2.2	Lecture, active learning, discussion	Quizzes, Assignments, tutorials & exams
3.0	Values, autonomy, and responsibility			
3.1	Discuss the issues to analyze the problem using properties table	V2.1	Lecture, active learning, discussion	Quizzes, Assignments, tutorials & exams
3.2	Soft skills: Discuss the skills and work under pressure to manage team work	V1.2	Lecture, active learning, discussion	Quizzes, Assignments, tutorials & exams
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction and basic concepts of thermodynamics (open and closed systems, control volumes, state and equilibrium, processes and cycles), dimensions and units of physical quantities	6
2.	Pressure & Temperature (Pascal's Law & Zeroth Law of Thermodynamics)	4

3	Work & Heat Transfer (during various processes) – 1st Law of Thermodynamics	5
4	Application of 1st Law of Thermodynamics	4
5	Non-flow process, Flow process and problem solving	Self Study Report
6	2nd Law of Thermodynamics- Heat Engine, Thermal Efficiencies, Coefficient of Performance. Basics of Refrigeration and Air-conditioning and their major components of evaporator, compressor, condenser and expansion devices. maintenance procedure of Air-conditioner and Refrigerator, leak testing, vacuuming and charging of refrigerant, and determination of COP of simple vapour compression refrigeration cycle	8
7	Properties of pure substance- Phase change process, Phase diagram, Use of properties table	4
8	Revision of course material	2
Total		33

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz #1	4th week	10%
2.	Midterm	7thweek	15%
3.	Self study report	3rd week	10%
4	Assignments, Tutorials and Oral exam	All weeks	10%
5	Soft skill (Lab work, Lab exam and Viva-voce)	All weeks	15%
6	Final Exam	As scheduled	40%

*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	• Engineering Thermodynamics" –M.ACHUTHAN – 2009 • "Basic and Applied Thermodynamics", by P.K. Nag, *Tata McHraw Hill Publishing Company Limited, New Delhi,*, 2002.
Supportive References	• Classroom policy • ''Introduction to Chemical Engineering Thermodynamics'',

	Smith J.M., Van Nees H.C., Abott M.M ، 7th ed. *Mc.Graw-Hill*, (2005). • "The Principles of Thermodynamics" by N.D. HariDass, *CRC Press, Taylor & Francis Group, London,* (2014). • "Fundamentals of Engineering Thermodynamics" by Michael J Moren& Howard N Shapiro, *John Wiley & Sons Inc. England,* (2006). • "Thermodynamics-An Engineering Approach", Yunes A Cengel&Michale A Boles, 8th Edition,*McHraw Hill Education*, (2014).
Electronic Materials	*www.learnthermo.com/*
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms should be furnished with • White board and appropriate Chairs • Laboratory with different temperature and pressure apparatus, as well as some experiments related to fluid Mechanics-Under graduate level
Technology equipment (projector, smart board, software)	Digital board, Computer with data show
Other equipment (depending on the nature of the specialty)	Not utilized

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Confidential student Course Evaluation Survey	Institution	Online Direct Survey
End of semester CLO	Course Coordinator	Direct Survey
Confidential student Course Evaluation Survey	Institution	Online Direct Survey
The extent to which CLOs have been achieved	Students	CLO survey, exams
Other		

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

Assessment Methods(Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	MET
REFERENCE NO.	CAITMET20232
DATE	12-03-2023