2023
TP-153

Course Specification
(Bachelor)

Course Title:	Thermodynamics-II
Course Code:	222-MEC-3
Program:	Bachelor of Science in Engineering
Department:	Mechanical Engineering
College:	College of Engineering
Institution:	Najran University
Version:	1.0
Last Revision Date:	02/27/2024

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 6					
4. Course general Description:					
Review of Basic Concepts of Thermodynamics, Law of Conservation of Energy, First Law for Closed/Open System, Steady Flow Energy Equation, Second Law of Thermodynamics, Energy and Entropy, Second Law Analysis, Gibb's Function, Helmholtz Function, Clausius and Clapeyron Equations. Thermodynamic Cycles: Carnot Cycle, Stirling Cycle, Ericsson Cycle, Joule Cycle, Otto Cycle, Diesel Cycle, Dua and Rankine Cycle. Steam Turbines: Types and Applications, Impulse and Reaction Turbine, Compounding of Turbines, Velocity and Acceleration Diagrams, Nozzles, Critical Pressure, Pressure Ratio. Condensers, its Classification, Types of Compressors, Effect of Inter-Cooling, Surging, Choking and Stalling. Boilers and its Classification, IC Engines, Types and Classifications, Calculation of Engine Performance, Suitability of Fuels					
5. Pre-requirements for this course (if any)**:**					
221-MEC-3(Thermodynamics1)					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
1. Illustrate the basic concepts of thermodynamics shall be revised for better understanding of the student. 2. Describe different thermodynamic cycles such as Carnot, Ericsson, Joule, Otto and Diesel Cycles and their comparison. 3. Explain the steam turbines and its thermodynamic efficiency along with its different parts and accessories.					

4. Investigate the different stages of condensation of steam in the generation of power and different compressors along with their installation.
5.Identify different types of boilers and engines and their performance characteristics in terms of efficiency and power.

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	**Demonstrate basic understanding of the concept of exergy (energy availability) and exergy analysis**	**1**	**TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based**	**-Test performance evaluation -Evaluation of participation in discussion and**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	of thermodynamic systems.		learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes from each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	group assignments
1.2	Illustrate the thermodynamic analysis of reacting mixtures and the applications in the analysis of combustion processes	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 from 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			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	Recognize thermodynamics knowledge in practical project, generate and analyze experimental data.	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 from 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
2.2				
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Decision making of materials selection for a certain job	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	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
			Exam from each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
3.2	Develop ideas, Creative thinking, and Practice Teamwork sharing with others	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 from 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
3.3	Defined the concept of exergy (energy availability) and exergy analysis of thermodynamic systems and Illustrate how thermodynamic relations used in evaluation of	3	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	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	thermodynamic properties		chapter with the CLO. TS:4 – Conducting midterm and Final Exam from each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	logical thinking questions •Quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	Irreversibility and availability.	10
2.	Thermodynamic relations.	10
3.	Chemical reactions and combustion.	10
4.	Phase and Chemical equilibrium.	10
5.	Thermodynamics of compressible flow.	10
6.	Applications using computer.	10
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	1-10	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 thermodynamics 8th edition** **Richard e. Sonntag, Claus Borgnakke , John Wiley & Sons, 2013**
Supportive References	**1.Steam and Gas Turbines by R Yadav, Central Publishing House, Allahabad** **2.Engineering Thermodynamics by R. Yadav, Central Publishing House, Allahabad** **3.Applied Thermodynamics Engineering Technology by T. D. Eastop & McConkey, ELBS Publications**
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