هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Thermal-Fluid System
Course Code:	493D-MEC-3
Program:	Bachelor of Science in Engineering
Department:	Mechanical Engineering
College:	College of Engineering
Institution:	Najran University
Version:	1.0
Last Revision Date:	27 February 2024

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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: (Fifth Year \ Level 9)					
4. Course general Description:					
Application of thermodynamics, mechanical engineering design, fluid mechanics, and heat transfer in the design of thermos-fluid systems. Introduction to system-oriented design methods. Thermo-fluid system component analysis, selection and design. Component and system modeling, simulation, economics and optimization.					
5. Pre-requirements for this course (if any)**:**					
323-MEC-3 (Heat Transfer)					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
Design of Thermo-Fluid Systems is a capstone course where students integrate previous coursework from different subfields including Fluid Mechanics, Heat Transfer, Thermodynamics, and Engineering Graphics.					

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**	45
2.	**Laboratory/Studio**	
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	Understand the basis and criteria of design for environment, safety and reliability, manufacturability and sustainability.	**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 chapter with the CLO. TS:4 – Conducting quizzes for 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
1.2	Apply design processes and procedures to design thermal systems.	**7**	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
			learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Giving more assignment for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	group assignments
2.0	**Skills**			
2.1	Develop a realistic thermal-fluid design of heating/cooling system including heat exchangers and work on individual components of a composite system.	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 for each chapter TS: 5 – 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	Simulate and optimize a thermal-fluid system using a computer (EES, Excel, Matlab, SolidWorks).	2	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.	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:4 – Conducting quizzes for each chapter. TS: 5 – Discussion with the students in the class hours	thinking questions •Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	Work as a team, dividing up tasks, setting deadlines, reviewing each other's work, working under a leader with a common objective, resolving conflicts	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 for 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
3.2	Understand codes of ethics and conduct for engineers in the workplace.	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 chapter with the CLO. TS:4 – Conducting midterm and Final Exam for 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	

C. Course Content

No	List of Topics	Contact Hours
1.	Engineering Design Process, Design of Thermal Systems.	8
2.	Design for Environment, Safety and Reliability	8
3.	Ethical concerns, Manufacturability and Sustainability	8
4.	Review of Fluid Mechanics, Piping systems, Pumps, Fans, Compressors, Turbines.	7
5.	Review of Heat Transfer, Heat Exchanger Selection and Design	7
6.	Power Generation, Refrigeration and HVAC Systems.	8
7.	Mathematical Modeling of Thermal Equipment & Systems and System Simulation & Computer Aided Design.	7
8.	Design Optimization & System Performance Evaluation and Exergy & Thermo-economic Analysis, Life Cycle Cost, Cost Estimation.	7
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	1-12	10%
2.	Quizzes	1-12	10%
3.	Mid-term	6 & 12	30%
4.	labs	-	-
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	Design and Optimization of Thermal Systems, Jaluria, Y., 2nd ed., McGraw-Hill, 2007.
Supportive References	Thermo-Fluids Systems Design, McDonald, A. G., and Magande, H. L., John Wiley, 2012. Design and Simulation of Thermal Systems, Suryanarayana, N. V. and Arici, Ö., McGraw-Hill, 2003
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	27/02/2024