2023
TP-153

Course Specification
(Bachelor)

Course Title:	Refrigeration and Air Conditioning
Course Code:	325-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

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: (Fourth Year \ Level 8)					
4. Course general Description:					
Introduction to refrigeration system, Vapour Compression & Air Refrigeration Systems: Analysis of V.C. System, Multi pressure System, Cascading V.C. Systems, Cold preservation of food, cold storage. Vapour Absorption Refrigeration System: Properties of binary mixture, processes executed by binary mixture, processes executed by binary mixtures, Aqua-Ammonia and LiBr Absorption systems. Refrigerants: Primary& secondary refrigeration, properties and selection of refrigerants. Impact of CFCs on Ozone layer and global warming, Alternatives of CFS's. Psychrometry of A.C. processes. Thermal comfort and Comfort chart, A.C. Systems, Cooling and heating loads. A.C. duct sizing, air distribution, fans, air cleaning, pipe sizing and layout. A.C. controls: elements of basic control systems.					
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):					
1.Develop the concepts of refrigeration and its related cycles. 2.Illustrate the principle of vapour compression refrigeration cycle and related calculations. 3.Develop the working principle of vapour absorption system and determine the related values for the practical use. 4.Develop clear understanding of different types of refrigerants with their related merits and demerits in daily life use. 5.Illustrate the fundamentals of air conditioning and its related calculations for practical application in daily life.					

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	Depict fundamental principles of refrigeration and air conditioning systems.	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.	-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
			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	
1.2	Describe various refrigeration cycles.	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 – 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**			
2.1	Create Air Conditioning system using cooling load calculations.	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.	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:4 – Conducting quizzes from each chapter TS: 5 – Discussion with the students in the class hours	•Quizzes
2.2	Analyze problems, conclude software solutions associated with refrigeration and air conditioning.	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. TS:4 – Conducting quizzes from 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
3.0	**Values, autonomy, and responsibility**			
3.1	Cooperate in work successfully as a part of a team through training on simulation software and presentations.	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	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: 6 – Discussion with the students in the class hours	
3.2	Review results and defend his ideas.	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 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

C. Course Content

No	List of Topics	Contact Hours
1.	Review of basic thermodynamics	8
2.	Vapor compression cycles	8
3.	Main components: compressor, condenser, evaporator, expansion valves	8
4.	Multi-stage and cascade vapor compression refrigeration.	8
5.	Refrigerants and their characteristics	8
6.	Introduction to absorption refrigeration	6
7.	Psychometry and psychometric processes	6
8.	Human comfort & Cooling load calculations aspects	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	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	Refrigeration and Air conditioning by C.P Arora, McGraw-Hill,2000
Supportive References	Refrigeration & Air Conditioning by G. F. Hundy, A. R. Trott and T. C. Welch, Butterworth Heinemann Publishers, 2008 Air Conditioning and Refrigeration Engineering by Shan K. Wang, Zalman Lavan and Paul Norton, CRC Press, New York, 2001
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

Assessment Areas/Issues	Assessor	Assessment Methods
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