2023
TP-153

Course Specification
(Bachelor)

Course Title:	Internal Combustion Engines
Course Code:	324-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: Fourth Year \ Level 7					
4. Course general Description:					
Introduction and Classification of IC Engines, 2 Stroke and 4 Stroke Engines, Concept of Combustion Processes, Scavenging, Super Charging and Turbo Charging. SI Engines: Stages of Combustion, Thermodynamic Analysis of Fuel Air Cycle, Abnormal Combustion, Fuel Metering and Fuel Injection Systems. CI Engines: Stages of Combustion, Significance of Delay Period, Premixed and Diffusion Combustion Process, Knocking, Fuel Metering and Fuel Injection Systems. Gas Turbine and Jet Propulsion, Thermodynamic Analysis of Actual Gas Turbine Cycle, Gas Turbine Cycle, Gas Turbine Combustors, Turbojet, Scramjet Engines, Rocket Engines. Fuels: Fuels used in SI and CI Engine and Gas Turbines, Non-Conventional Fuels, Fuel Characteristics and their Rating, Emission and Control from Si and CI Engines					
5. Pre-requirements for this course (if any)**:**					
222-MEC-3 (THERMODYNAMICS2)					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
1 Develop capability to differentiate between different types of IC Engines and their processes. 2. Analyze the different stages of SI Engine processes on different parameters. 3. Analyze different testing parameters of CI Engines. 4. Identify the basics of Gas Turbine and Jet propulsion technology. 5. Illustrate the characterization of different fuels that are used in IC Engines.					

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	**Students may achieve a basic level of understanding of the operation of various engines and may be able to deal with study of various engine systems as well.**	**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	**The students, at the end of the course, should be able to use this subject information for future research & development in higher studies.**	**7.3**	**TS:1-Interactive lectures using PowerPoint slides with more examples in the class** **TS:2- Engaging the students in problem-based learning through tutorials** **TS:3- Lab Demonstrations** **TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students.** **TS: 5 – Conducting oral quizzes by the end of each chapter** **TS:7 – Giving more example programs in the lecture**	**-Test performance evaluation** **-Evaluation of participation in discussion and assignments** **-Quizzes and Mid Terms** **-Final exam**
...				
2.0	**Skills**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	The student shall be able to understand the functionality and concepts of IC engines and its development.	2	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning through tutorials TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Conducting oral quizzes by the end of each chapter TS:7 – Giving more example programs in the lecture	-Test performance evaluation -Evaluation of participation in discussion and assignments -Quizzes and Mid Terms -Final exam
2.2				
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Students can participate in class discussion and think critically	3	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning through tutorials	-Test performance evaluation -Evaluation of participation in discussion and assignments -Quizzes and Mid Terms -Final exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:3- Lab Demonstrations **TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students.** **TS: 5 – Conducting oral quizzes by the end of each chapter** **TS:7 – Giving more example programs in the lecture**	
3.2	**Students can act responsibly and ethically in carrying out individual as well as group projects**	**4**	**TS:1-Interactive lectures using PowerPoint slides with more examples in the class** **TS:2- Engaging the students in problem-based learning through tutorials** **TS:3- Lab Demonstrations** **TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students.** **TS: 5 – Conducting oral quizzes by the end of each chapter** **TS:7 – 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
3.3	Students have the necessary skills to communicate, listen, negotiate, and evaluate their strengths and weaknesses as members of a team	3.5	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning through tutorials TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Conducting oral quizzes by the end of each chapter TS:7 – 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

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to IC Engines; Defining important terms and parameters.	10
2.	Design features and operating characteristics of different types of Internal combustion engines: spark-ignition, diesel.	10
3.	Combustion chamber design, and octane number.	10
4.	Performance parameters. The fundamentals of how the design and	10
5.	The operation of internal combustion engines affects their performance, Operation, and fuel requirements.	10
6.	Gas exchange processes and volumetric efficiency	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	Internal Combustion Engines by V. Ganesan, Tata McGraw Hill Publications, 2013
Supportive References	1. Internal Combustion Engines Fundamentals by John Heywood, McGraw Hill Publications,2012 2. Internal Combustion Engines and Air Pollution by Edward F. Obert, Harper and Row Publishers, 1973 3. Internal Combustion Engines by M. L. Mathur, R. P. Sharma, Dhanpat Rai & Sons Publications, 2005
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