هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Mechatronics
Course Code:	391A-MEC-2
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: (2)					
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 mechatronics, systems, measurement systems, control systems, microprocessor-based controllers, The mechatronics approach, Sensors and transducers, performance terminology, Displacement position and proximity, velocity & motion, Force, Fluid pressure, Temperature, Light sensors, Selection of sensors, Inputting data by switches. Signal conditioning, The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing, Pulse - modulation, Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition systems, Measurement systems, Measurement systems, Testing and calibration. Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure control valves, Cylinders, Process control valves, rotary actuators. Mechanical systems, Types of motion, Kinematics chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection. Electrical systems, Mechanical Switches, Solid-state switches, Solenoids, DC motors, AC motors, Stepper motors, Mathematical models, mechanical system building blocks, Electrical system building blocks, Thermal system building blocks					
5. Pre-requirements for this course (if any)**:**					
213-MEC-3 (Mechanics of Materials) 216-EE-3 (Electrical Circuits (1))					
6. Co-requisites for this course (if any)**:**					
NIL					

7. Course Main Objective(s):
1. Introduce the concept of mechanical systems with electronics control and operation. 2. Understand the application of instruments in obtaining the signals and data processing with proper measurement. 3. Understand the concept of actuators in operating mechanical systems. 4. Understand the application of different mechanical systems with their relative motions and transmissions. 5. Introduce the electrical and mechanical switches in building the mechanical system for practical applications.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	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**	
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		45

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 concepts of mechanical systems with electronics control operations.	1	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Associating the topics in each chapter with the CLO. TS:6 – Conducting oral quizzes by the end of each chapter	-Test performance evaluation -Evaluation of participation in discussion and assignments -Quizzes and Mid Terms -Final Exams
1.2	Understand the application of instruments in obtaining the signals and data.	7	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Associating the topics in each	-Test performance evaluation -Evaluation of participation in discussion and assignments -Quizzes and Mid Terms -Final Exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			chapter with the CLO. TS:6 – Conducting oral quizzes by the end of each chapter	
2.0	**Skills**			
2.1	Able to perform data analysis and measurement	2	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Associating the topics in each chapter with the CLO. TS:6 – Conducting oral quizzes by the end of each chapter	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
2.2	Able to use the different types of actuators in designing an automation system.	6	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students.	•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 – Associating the topics in each chapter with the CLO. TS:6 – Conducting oral quizzes by the end of each chapter	
3.0	**Values, autonomy, and responsibility**			
3.1	Able to build system for practical applications.	4	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Associating the topics in each chapter with the CLO. TS:6 – Conducting oral quizzes by the end of each chapter	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
3.2	Understand the use of different types of motions in designing a system.	6	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2- Engaging the students in problem-based learning TS:3- Lab Demonstrations TS: 4 – Recall the topics discussed in the last lecture by	•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
			asking questions to the students. TS: 5 – Associating the topics in each chapter with the CLO. TS:6 – Conducting oral quizzes by the end of each chapter	

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to mechatronics, systems, measurement systems, control systems, microprocessor-based controllers	5
2.	The mechatronics approach, Sensors and transducers, performance terminology, Displacement position and proximity, velocity & motion, Force, Fluid pressure, Temperature, Light sensors, Selection of sensors	5
3.	Inputting data by switches. Signal conditioning, The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing	5
4.	Pulse - modulation, Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition systems	5
5.	Measurement systems, Measurement systems, Testing and calibration. Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure control valves, Cylinders, Process control valves, rotary actuators	6
6.	Mechanical systems, Types of motion, Kinematics chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection	7
7.	Electrical systems, Mechanical Switches, Solid-state switches, Solenoids, DC motors, AC motors, Stepper motors	7
8.	Mathematical models, mechanical system building blocks, Electrical system building blocks, Thermal system building blocks	5
Total		**45**

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.	Lab final exam	-	-
6.	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	**Mechatronics** - W. Bolton, 2 Ed. Addison Wesley Longman, Pub, 1999 (Delhi)
Supportive References	**1. Mechatronics by** HMT, TMH. **2. Introduction to Robotics Mechanics and Control,** Third Edition, John J. Craig ISBN 0201-54361-3; Prentice Hall **3. Analytical Robotics and Mechatronics,** Wolfram Stadler, ISBN 0-07-060608-0, McGraw-Hill
Electronic Materials	Online custom books
Other Learning Materials	N/A

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms and laboratories
Technology equipment (projector, smart board, software)	Projector.
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**