

# University of Management and Technology

## Course Outline

Course code: ET 206

Course title: Introduction to Mechatronics

Program	BSc Aircraft Maintenance Engineering Technology	
Credit Hours	02+01	
Duration	15 weeks	
Prerequisites	Nil	
Resource Person	Zukhraf Jamil	
Counseling Timing (Room# )	Monday	10:00 to 13:00
	Wednesday	11:00 to 16:00
	Friday	10:00 to 14:00
Contact	Zukhraf.jamil@umt.edu.pk	

Chairman/Director signature.....

Dean's signature.....

Date.....

## Learning Objective:

The course aims to familiarize students with Mechatronics as a multidisciplinary area with a particular focus on applications of mechatronics in aircraft industry. The course is to elaborate the fundamentals and principles of mechanics, computing, and electronics and how they are integrated to make mechatronics systems. The content is designed with a particular focus on key components of mechatronics systems including sensors, actuators, controllers, and their working. Case studies are included to get students acquainted with the application and impact of mechatronics systems on aircraft industry.

Upon successful completion of the course, the student should be able to:

S No	CLO Statement	PLO	Learning Domain and level
1.	Understand the fundamental principles of mechanics, computing, and electronics involved in the development of mechatronics systems.	1	C1
2.	Apply the obtained engineering knowledge in identifying and comprehend the role of mechatronics systems and their components in functioning of various systems in aircraft.	1	C3
3.	Analyze various electromechanical systems involved in the development and repair of aircraft systems	2	C4
4	Use the fundamental knowledge in developing the understanding of mechatronics systems and be able to do feasibility study on the use of such systems for proposing solutions for maintenance industry	6	C4
5.	Conduct and Interpret the results of experiments conducted on electromechanical instruments.	3	P3
6.	Effectively communicate experiment results through both written reports and oral Presentations.	10	P3

## 1. CLO – PLO MAPPING:

CLOs	PLOs											
	Engineering Technology Knowledge	Problem Analysis	Design / Development of Solutions	Investigation	Modern Tool Usage	The Engineering Technologist and Society	Environment and Sustainability	Ethics	Individual and Team Work	Communication	Project Management	Lifelong Learning
	1	2	3	4	5	6	7	8	9	10	11	12
1	C1											
2	C3											
3		C4										
4						C4						
5			P3									
6									P3			

### Learning Methodology:

- The course content is designed as a mixture of theory lectures and handouts.
- To ensure students' understanding, lab demonstration, case studies' evaluation and worked examples involving hands on practice are designed as part of the course.
- Participants will be evaluated based on class/lab assignments and quizzes (*announced and unannounced*) from theory, worked examples and individual/group presentations.

### Recommended Text Books:

David G. Alciatore and Michael B. Hstand, *Introduction to Mechatronics and Measurement Systems*, 2nd Ed., McGraw Hill, 2007

### Reference Books:

1. Robert H. Bishop, *Mechatronics: An Introduction*, CRC Press, 2006
2. Norman S. Nise, *control Systems Engineering*, John Wiley & Sons, Inc.

## Grade Evaluation Criteria

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

### Theory:

<b>Marks Evaluation</b>	<b>Marks in percentage</b>
Quizzes (x6)	15%
Assignments (x2)	10%
Evaluation(Viva)	5%
Presentation	5%
Mid Term Examination	25%
End Term Examination	40%
<b>Total</b>	<b>100 %</b>

### Practical:

<b>Marks Evaluation</b>	<b>Marks Percentage</b>
<b>Class activity</b>	5%
<b>Team work</b>	5%
<b>Quizzes</b>	15%
<b>Viva</b>	5%
<b>Lab Report</b>	10%
<b>Final Evaluation</b>	60%
<b>Total</b>	<b>100%</b>

## Calendar of Course contents to be covered during semester

Course code: ET 206

Course title: Introduction to Mechatronics

Week	Course Contents	Reference Chapter(s)	Quiz	Assignments	CLOs
1	Introduction mechatronics, its definitions, and applications Introduction to sensors, transducers, and actuators, their characteristics as general, glossary of related terms	Class notes by text and ref book	1	0	1
2	Types of transducers according to their function and working principles	Class notes by text and ref book			
3	Introduction to actuators Characteristics and working of mechanical, electrical, and electromechanical actuators	Class notes by text and ref book	1	0	1,3
4	Hydraulic and pneumatic actuation systems	Class notes by text and ref book			

5	Introduction to ADC and DAC	Class notes by text and ref book			
6	Mechanical designs Static and dynamic stress analysis of mechanical structures	Class notes by text and ref book	1	1	1,3
7	Mathematical modelling of first and second order systems	Class notes by text and ref book			
8	Mid Term Examination				
9-10	Time response of first and second order systems Frequency Response of first and second order systems	Class notes by text and ref book	1	1	1,3
11-12	Design via Frequency Response Controller design in frequency domain	Class notes by text and ref book	1	1	1,3

13	Signal conditioning and introduction to discrete time and nonlinear systems	Class notes by text and ref book			
14-15	System's stability criteria and system's stability design using root locus method Case Studies	Class notes by text and ref book	1	1	1,4

## Introduction to Mechatronics Lab Outline

SR No.	Experiment Title.	CLOs
1	Temperature and Resistance Measurement Using Wheatstone Bridge	5,6
2	Study the behavior of Thermal Sensors	
3	Design of basic signal conditioning using operational amplifier as voltage follower, inverting, non-inverting, summing, integrator, & differential amplifier	
4	Use of 8051 microcontroller for 8 bit addition and subtraction	
5	Use of AT Mega 328 Microcontrollers with arduino in data processing and control	
6	Using MATLAB for Control Systems	
7	Scripts, functions, and flow control in MATLAB	
8	Linear Time-invariant Systems and Representation in MATLAB/SIMULINK	
9	Analysis of 1 <sup>st</sup> and 2 <sup>nd</sup> Order systems' responses to Impulse, Step, and Ramp Inputs and effect of damping on system's response	
10	System's stability analysis using Root Locus, Bode plot, and Nyquist plot.	
11	Introduction to PID controller in MATLAB/SIMULINK	



## Class Policy

### STUDENTS ARE REQUIRED TO READ AND UNDERSTAND ALL ITEMS OUTLINED IN THE PARTICIPANT HANDBOOK

**CLASS ATTENDANCE:** Students need to be in class at the assigned time. After 10 minutes past the assigned time, the students will be marked absent.

**TURN OFF MOBILE PHONE!** It is unprofessional to be texting or otherwise.

**READ EMAILS!** Participants should regularly check their university emails accounts regularly and respond accordingly. Students would be responsible if they miss a deadline because of not reading the emails.

**CLASS ATTENDANCE POLICY:** A minimum of 80% attendance is required for a participant to be eligible to sit in the final examination. Being sick and going to weddings is absence and will not be counted as present. Participants with less than 80% of attendance in a course will not be allowed to take end term exams. International students who will be leaving for visa during semester should not use any days off except for visa trip to avoid reaching short attendance.

**MOODLE:** UMT –LMS (Moodle) is an Open Source Course Management System (CMS), also known as a learning Management System (LMS). Participants should regularly visit the course website on MOODLE Course Management system, and fully benefit from its capabilities. In case of any problem while using MOODLE, visit <http://oit.umt.edu.pk/moodle>. For queries email [moodle@umt.edu.pk](mailto:moodle@umt.edu.pk)

**HARASSMENT POLICY:** Sexual or any other harassment is prohibited and is constituted as punishable offence. Sexual or any other harassment of any participant will not be tolerated. All actions categorized as sexual or any other harassment when done physically or verbally would also be considered as sexual harassment when done using electronic media such as computers, mobiles, internet, emails etc.

**USE OF UNFAIR MEANS/ HONESTY POLICY:** Any participant found using unfair means or assisting another participant during a class test/quiz, assignments or examination would be liable to disciplinary action.

**PLAGIARISM POLICY:** All students are required to attach a “Turnitin” report on every assignment, big or small. Any student who attempts to bypass “Turnitin” will receive “F” grade which will count towards the CGPA. The participants submit the plagiarism report to the resource person with every assignment, report, project, thesis etc. If student attempts to cheat Turnitin, a second “F” will be awarded that will count towards the CGPA. There are special rules on plagiarism for final reports etc. all outlined in your handbook.

**COURSE WITHDRAWAL POLICY:** Students may withdraw from a course till the end of the 12th week of the semester. Consequently, grade ‘W’ will be awarded to the student which shall have no impact on the

calculation of the GPA of the student. A Student withdrawing after the 12th week shall be automatically awarded "F" grade which shall count in the GPA.

**COMMUNICATION OF RESULTS:** The results of quizzes and assignments are communicated to the participants during the semester and answer books are returned. It is the responsibility of the course instructor to keep the participants informed about his/her progress during the semester. The course instructor will inform a participant at least one week before the final examination related to his or her performance in the course.

**Faculty Signature .....**                      **Date.....**