

BMEE210L	Mechatronics and Measurement Systems	L	T	P	C
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Pre-requisite	Nil	Syllabus version			
		1.0			
Course Objectives					
<ol style="list-style-type: none"> 1. To familiarize key elements of mechatronics system, impart knowledge of the elements and techniques involved in mechatronics systems for industrial automation. 2. To impart the theoretical and practical aspects of measurement system design. 3. To give insight to the principles of sensors & actuators, and their interfacing with DAQ. 					
Course Outcomes					
At the end of the course, the student will be able to					
<ol style="list-style-type: none"> 1. Demonstrate the basic concepts, applications and elements of mechatronic systems. 2. Analyze various measuring instruments for different applications. 3. Compare various types of sensors and actuators used in mechatronics systems. 4. Apply the concept of signal processing and use of interfacing systems. 					
Module: 1 Basics of Mechatronics Systems					
					6 hours
Basic concepts in mechatronics, Mechatronics systems design approach, Key elements of mechatronics system, Role of sensors, actuators and measurements-Feedback in mechatronics systems- Emerging application areas of mechatronics.					
Module: 2 Measurement System					
					6 hours
Introduction to measurement, Standards of measurement, Modes of measurement, generalized measurement system, Applications of Measurement System, Errors in measurement, sources of errors. Specifications: Sensitivity, resolution, bias, dead space-Static and dynamic characteristics- System response.					
Module: 3 Basic Sensors					
					7 hours
Position and Speed Measurement- Proximity Sensors and Switches, Potentiometer, Linear Variable Differential Transformer, Digital Optical Encoder; Stress and Strain Measurement - Electrical Resistance Strain Gauge, Measuring Resistance Changes with a Wheatstone Bridge, Measuring Different States of Stress with Strain Gauges.					
Module: 4 Advanced Sensors					
					7 hours
Force Measurement with Load Cells; Temperature Measurement- Liquid-in-Glass Thermometer, Bimetallic Strip, Electrical Resistance Thermometer, Thermocouple; Vibration and Acceleration Measurement - Piezoelectric Accelerometer; Pressure and Flow Measurement; Capacitive sensors- Fiber optic sensors-Semiconductor Sensors and Microelectromechanical Devices:IMU,Gyroscope.					
Module: 5 Actuators					
					6 hours
Electromagnetic Principles-Solenoids and Relays-Electric Motors- DC Motors-Stepper Motors-Hydraulics- Hydraulic Valves, Hydraulic Actuators; Pneumatics.					
Module:6 Data Acquisition					
					6 hours
Introduction to Data Acquisition-Quantizing Theory-Analog-to-Digital Conversion- Digital-to-Analog Conversion-Signal Conditioning-Computer Based Instrumentation Systems-Software Design and Development-Data Recording and Logging-The Intelligent Multivariable Measurement System.					
Module:7 Measurement Systems					
					5 hours
Linear and angular measurements – taper measurement, threads, surface finish, inspection of straightness, flatness and alignment- Comparators - Gear testing-Coordinate measuring machines, Optical Tool Maker's Microscope, Profile Projector.					
Module:8 Contemporary Issues					
					2 hours
Total Lecture hours:					45 hours

Text Book(s)			
1	Alciatore, D.G. and Histan, M.B. Introduction to mechatronics and measurement systems. 2019, New York, Ny: Mcgraw-Hill Education.		
2	Bewoor, A.K. and Kulkarni, V.A., Metrology & Measurement, 2009, McGraw-Hill Education.		
Reference Books			
1.	DeSilva, C.W., Farbod Khoshnoud, Li, M. and Halgamuge, S.K, Mechatronics : Fundamentals and Applications. Boca Raton: 2016, CRC Press, Taylor & Francis Group.		
2	William Charles Bolton, Mechatronics: electronic control systems in mechanical and electrical engineering. 2019, Harlow, England: Pearson.		
3.	Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard, Mechanical Measurements, 2009, Pearson Education.		
4	Cesare Onwubolu Godfrey C Fantuzzi, Mechatronics: Principles and applications, 2020, S.L.: Butterworth-Heinemann Ltd.		
5	Bentley, J.P. (2008). Principles of measurement systems. Harlow Pearson Prentice Hall.		
Mode of Evaluation: CAT, Written assignment, Quiz, FAT.			
Recommended by Board of Studies		09-03-2022	
Approved by Academic Council		No. 65	Date 17-03-2022