Identification	Subject	ME 450, Metrology and Quality Control, 6 ECTS	
	Department	Mechanical Engineering	
	Department Mechanical Engineering Program Undergraduate		
	Term Fall, 2024		
	Instructor	Faraj Khalikov	
	E-mail:	f.khalikov@wesa.az	
	Phone:	<u>I.Khankov@wcsa.dz</u>	
	Classroom/hours		
D	Office hours		
Prerequisites			
Language	English		
Compulsory/Elective	Compulsory		
Required textbooks and course materials	Main textbook: 1- Gupta. I.C., "Engineering Metrology", 7th edition, Dhanpatrai Publication, 2012.		
		ngineering Metrology", Khanna Publishers, 21st edition, 2005.	
Course outline		logy and Quality Control" offers an in-depth exploration of	
	measurement science	ce and its role in manufacturing. It begins with foundational	
	concepts in metrole	ogy, including the importance of SI units and measurement	
	standards. Students	will learn about various measurement systems, instruments, and	
	the processes of calibration and error analysis.		
Course objectives	The objective of the course "Metrology and Quality Control" is to equip students with		
Learning outcomes	a thorough understanding of the principles and applications of measurement science in engineering and manufacturing processes. Students will learn to accurately measure and assess the quality of components using various instruments and techniques, ensuring proper calibration and error analysis. The course aims to develop proficiency in interpreting tolerances, limits, and fits, as well as applying statistical quality control methods such as control charts and process capability analysis. Students will also gain hands-on experience with advanced metrology tools, including coordinate measuring machines (CMMs) and non-contact measurement systems, and understand how to implement quality management systems in line with international standards like ISO 9000. By the end of the course, students will be able to apply metrology and quality control methods to ensure the precision, reliability, and continuous improvement of manufacturing processes.		
Learning outcomes	demonstrate a comp metrology in engine appropriate measuri error analysis. Stud limits, and fits in th proficient in utilizin process capability Additionally, studen such as coordinate implementation of standards like ISO	e course "Metrology and Quality Control," students will be able to prehensive understanding of the principles and applications of eering and manufacturing. They will be able to select and use ing instruments, conduct accurate measurements, and perform ents will develop the ability to interpret and apply tolerances, he design and manufacturing of components. They will also be g statistical quality control techniques, such as control charts and analysis, to monitor and improve manufacturing processes. Its will gain practical experience with advanced metrology tools, e measuring machines (CMMs), and will understand the quality management systems in accordance with international 9000. Ultimately, students will be able to apply metrology and ctices to ensure product precision, reliability, and continuous ustrial settings	
Teaching methods	Lecture	Х	
	standards like ISO guality control practimprovement in indu	9000. Ultimately, students will be able to apply metrology and ctices to ensure product precision, reliability, and continuous	
Teaching methods	Lecture	Х	

Experiential exercise x Case analysis x Evaluation Methods Date/deadlines Percentage (%) Midterm Exam 25 Class Participation 5 Quiz 10 Project 20 Final Exam 40 Total 100 Project 20 Final Exam 40 Total 100 Project 20 Final Exam 40 Total 100 Propertion of class 100 Preparation for class The structure of this course demands your individual effort outside the classroon for extra practice of many problems within the textbook. After each session, ever student needs to put sufficient time to practice and finish the assignments by the predetermined date. Withdrawal (pass/fail) This course strictly follows grading policy of the School of Engineering. Thus, student is normally expected to achieve a mark of at least 60% to pass. In case o failure, hicks with a terguired to repeat the course the following term or year. Cheating or other plagarism Methodize abours. Unauthorized discussions an unerthical behavior are strictly discouraged. Attendance Students shall		Group discussion		х		
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Week	Date/Day (tentative)	Topics	Textbook/Assignments
1		 Introduction to Metrology Overview of Metrology and Quality Control Importance of Measurement in Manufacturing Measurement Standards: SI Units 	Textbook-1 Chapter 1-2
2		 Measurement Errors and Uncertainty Types of Measurement Errors: Systematic and Random Accuracy, Precision, and Resolution Concepts of Uncertainty in Measurement 	Textbook-1 Chapter 3
3		 Measuring Instruments: Linear Measurements Vernier Calipers, Micrometers, and Dial Indicators Gauge Blocks and Slip Gauges Calibration of Linear Measuring Instruments 	Textbook-1 Chapter 4
4		 Angular and Form Measurement Tools for Angular Measurement: Sine Bars, Bevel Protractors Measurement of Angles, Straightness, Flatness, and Roundness 	Textbook-1 Chapter 5
5		 Surface Roughness and Texture Measurement Concepts of Surface Roughness and Texture Instruments for Measuring Surface Finish Surface Roughness Parameters 	Textbook-1 Chapter 6-7
6		 Tolerances, Limits, and Fits Introduction to Tolerances and Fits ISO Standards for Tolerances Types of Fits: Clearance, Interference, and Transition Fits 	Textbook-1 Chapter 8
7		 Advanced Metrology: Coordinate Measuring Machines (CMM) Types of CMMs and Their Applications Operation and Programming of CMMs Inspection of Complex Geometries 	Textbook-1 Chapter 9
8		Review, Midterm Exam	
9		 Optical and Non-contact Measurement Techniques Laser-based Measurement Systems Optical Projectors, Interferometers, and Vision Systems Non-contact Techniques: Ultrasonic and Optical Methods 	Textbook-1 Chapter 10
10		 Introduction to Statistical Quality Control (SQC) Basics of Quality Control Control Charts: X-bar, R-chart, P-chart Process Capability: Cp and Cpk 	Textbook-1 Chapter 11
11		Process Capability and Six Sigma	Textbook-1

	Process Improvement with Six Sigma	Chapter 11
	DMAIC Methodology	
	Analyzing Process Capability and Variation	
	Inspection Techniques	
	In-process, Final, and Automated Inspection	Textbook-1
12	Acceptance Sampling and Inspection Plans	Chapter 11
	Automated Inspection Systems: Vision Systems	
	and Robotics	
	Quality Management Systems (QMS)	
	• Introduction to QMS: ISO 9000 and Other	Additional reading
13	Standards	material will be provided as a PDF
	Auditing and Continuous Improvement	
	Quality Documentation and Records	
	Case Studies and Industrial Applications	
	Real-world Case Studies in Metrology and Quality	Additional madina
14	Control	Additional reading material will be provided
14	Applications of Metrology in Precision	as a PDF
	Manufacturing	
	Failure Analysis and Its Impact on Quality	
15	Project Presentation and Review	
	Student Group Project Presentations	
16	Final Exam/ Delivery of assignments	