



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Fabrication Technology

Subject Code: DI04055011

Subject Name: Engineering Metrology & Instrumentation Control

w. e. f. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	PCC

Prerequisite:	-
Rationale:	This course provides the knowledge and practice regarding measurement and inspection of different types of fabricated items, process piping, structural items and mechanical parts. The course develops skills for using and calibrating different measuring instruments used in fabrication & process industries. As you know the exact and precise measurements are the basic need of the manufacturing industries. This course of engineering metrology & instrumentation control therefore provides necessary knowledge and skills for accurate & precise measurements for manufacturing and creates quality consciousness. This course may build confidence among the students for developing employable skills required in fabrication industries.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Measure the given job using appropriate linear measuring instrument.	U
02	Measure the given job using appropriate angular measuring instrument.	U
03	Use different types of gauges for inspecting given job.	U
04	Describe the temperature, pressure and flow measuring instruments.	U
05	Perform inspection of various elements of given process equipment.	U

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Linear measurement 1.1 Definition, concept and objectives of metrology 1.2 Principles, process and methods of measurement 1.3 Need, importance and types of standards 1.4 Interchangeability and selective assembly 1.5 Fundamental linear measuring unit and their conversion 1.6 Concept of computer aided inspection 1.7 Static characteristics of measuring instrument 1.8 Direct and indirect measuring instruments 1.9 Construction, working principle, least count of various linear measuring instruments. 1.10 Errors in measurements 1.11 Working and use of dial indicator. 1.12 Selection of measuring instrument. 1.13 Straightness, flatness, squareness and roundness measurement 1.14 Calibration of measuring instrument vernier caliper & micrometer	15	34
2.	Angular and surface roughness measurement 2.1 Construction, working principle, least count of various angular Measuring instruments. 2.2 Optical angular measuring instruments, clinometers, auto Collimator, angle Dekker etc. 2.3 Surface roughness terminology 2.4 Direct and indirect surface roughness measuring system 2.5 measurement of surface roughness and computation of profile 2.6 Relationship of machining process and surface texture	8	17
3.	Limit gauges & transducers 3.1 Concept of gauging, 3.2 Measurement VS gauges 3.3 Advantages, limitation and classification of gauges 3.4 Application of limit gauge 3.5 Weld gauge - classification, Sketch and its applications. 3.6 Gauges material 3.7 Introduction, advantages and Classification of Transducers.	5	11



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	3.8 Concept of generalize measuring System		
4.	Instrumentation control in process industries 4.1 Temperature measurement 4.2 Pressure measurement 4.3 Flow measurement 4.4 Calibration of pressure gauge, temperature measuring device	10	23
5.	Inspection 5.1 Need of inspection in industry 5.2 Types of inspection 5.3 Centralized and decentralized inspection system 5.4 Ethical and essential requirement of welding inspector 5.5 Responsibilities of welding inspector 5.6 Inspection of process equipment 5.7 Welding inspection operation 5.8 Role of third party inspection agencies in field of fabrication 5.9 Inspection VS quality control	7	15
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
40 %	40%	20 %	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	A textbook of metrology	M. Mahajan	Dhanpat rai & co.
2	Engg. metrology	R. K. Jain	Khanna Publishers, Delhi
3	Mechanical measurement & instrument	R. K. Rajput	S. K. Kataria & Sons



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Sr. No.	Title of Book	Author	Publication with place, year and ISBN
4	Mechanical measurement	Dr. D. S.Kumar	Metropolitan Book Pub.
5	Mechanical measurement	R. K. Jain	Khanna publishers
6	Statistical Quality Control	M. Mahajan	Dhanpat rai & co.
7	Industrial Instrumentation & Control	S K Singh	Tata McGrawHill
8	Practical Engineering Metrology	K.W.B.Sdarp	Pitman

(b) Open source software and website:

- https://youtu.be/3nio_KKMbnU
- <https://youtu.be/BqAmLOI8uzs>
- <https://youtu.be/u8UW9O1UHCw>
- <https://youtu.be/VtMBICpCfew>
- <https://youtu.be/xPUjQAtre7Q>
- <https://youtu.be/vkPlzmalvN4>
- <https://youtu.be/vMgKQegeV24>
- <https://youtu.be/saoOUXYXde0>
- <https://youtu.be/qwEB0wEfQTg>
- <https://youtu.be/dzhh82H2Nuk>
- <https://youtu.be/As5kzxkyT24>
- <https://youtu.be/uWX5larryDY4>
- <https://youtu.be/sHmjE21Fp9w>
- <https://youtu.be/9VpimWrPTaM>
- <https://youtu.be/RARjXXaFEQ0>
- <https://youtu.be/gByrUkZUnKo>
- <https://youtu.be/3zmF7qRb9pI>
- <https://youtu.be/b12XN3G4GaU>
- <https://youtu.be/pG3UFnIYSeI>
- <https://youtu.be/fXYdSEli88Y>
- <https://youtu.be/oIiWsgbGAE>
- <https://youtu.be/iwasC3G141w>



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Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Approx. Hrs. Required
1	Measure length, width, diagonal length & thickness of plate by using 3 meter measure - tap.	2
2	Measure Length, OD, ID & Depth of given job using Vernier Caliper.	2
3	Perform marking operation by using vernier height gauge. (Optional)	2
4	Measure OD, ID & Depth of given job using Micrometer.	2
5	Measure Straightness of given job using dial gauge / spirit level.	2
6	Measure Flatness of given job using dial gauge / spirit level. (Optional)	2
7	Measure Roundness of given job using dial gauge. (Optional)	2
8	Calibrate Vernier caliper and micrometer screw.	2
9	Prepare set of Slip Gauges for given dimension using M112 slip gauge set.	1
10	Calculate a set of Angle Gauges for given angle using angle gauge set.	1
11	Measure angle of given job using Universal Bevel Protractor.	2
12	Measure angle between two planes with the help of sine bar. (Optional)	2
13	Demonstrate Indirect measuring methods with instruments for surface roughness measurement. (Optional)	2
14	Measure a given job using snap/ring gauge. (Optional)	2
15	Measure a given job using plug gauge and different radius gauge.	2
16	Measures a Thread of given job by using thread gauge & screw pitch gauge	2
17	Demonstrate use of temperature, pressure and flow measuring instruments.	2
18	Perform inspection of welded joint for Process Equipment.	2



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Sr. No.	Practical Outcomes (PrOs)	Approx. Hrs. Required
19	Prepare inspection report of process equipment.	2
	TOTAL HOURS.	30

Note

- More **Practical Exercises** can be designed and offered and can be changed by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*
- Boiler suit, safety shoes, other safety items & hand tools are compulsory while attending laboratory and has to be brought by students.*
- Optional practical may be selected by teacher as per availability of resource and time.*

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications
1.	3 meter measure tape
2.	Simple vernier caliper, dial vernier caliper, digital vernier caliper, Vernier height gauge.
3.	Outside micrometer, inside micrometer, depth micrometer
4.	Slip gauge set
5.	Angle gauge set
6.	Dial gauge with magnetic stand and V- blocks
7.	Bevel protractor and its set
8.	Sprit level
9.	Surface plate
10.	Sine bar
11.	Indirect measuring instruments for surface roughness measurement
12.	Sample of various surface texture and different surface roughness.
13.	Plug gauge, ring gauge, snap gauge, standard wire gauge, taper gauge, thread gauge, Weld gauge ; radius gauge, pitch gauge, standard gauge etc.



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Sr. No.	Equipment Name with Broad Specifications
14.	Various Temperature, Pressure and flow and measuring instruments.
15.	Different stationary sets and drawing instruments etc.

Suggested Project List:

1. Prepare a quiz on topic given faculty members.
Chart making: Prepare the charts on different topic given by faculty.
2. Video Preparation: Student has to prepare his/her video on explaining different topics of subjects given by faculty.
3. E-learning projects: Students have to use internet and other online resources for preparation of report and/or download video on the topic given by the subject teacher within the syllabus or beyond the syllabus.
4. Report preparation: Student has to use different books, technical magazine, journals etc. for preparation of a report on the topic given by the subject teacher within the syllabus or beyond the syllabus.
5. Power point presentation: Students has to prepare a power point presentation of 10 to 15 slides on the topic given by the subject teacher within the syllabus or beyond the syllabus. In the end of presentation student has to ask at least 3 to 5 MCQ based question to identify the gain of listeners at the end presentation.

Suggested Activities for Students:

1. Prepare sketchbook of drawing of various topics of syllabus
2. Prepare a question bank.
3. 10 min PPT presentation on the given topic from the syllabus or beyond the syllabus
4. Report writing on various topics from syllabus and beyond syllabus
5. Prepare a demonstration model, charts, projects etc. by topic given by faculty.

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ANNEXURE-1: SAMPLE SAFETY CONTRACT

(To be filled by the students and submitted to concerned faculty/staff)

-- Use for reference purposes only --

1. You have to read and sign the safety contract.
2. The safety contract says that you understand that safety is your responsibility.
3. The safety contract to be signed before you carries out any work in the laboratory and if you don't observe and obey the safety rules, you will not be allowed in the laboratory.

.....

Safety Contract

Date: _____

Name of Institute: _____

Name of Course with Code: Engineering Metrology & Instrumentation Control (_____)

Name of Faculty/Staff with Designation: 1. _____

2. _____

3. _____

I RECOGNIZE THAT:

1. Safety is my responsibility when using a tool.
2. Safety regulations have been provided to me.
3. The possibility of accident and injury increases if I do not follow all the safety guidelines.
4. I must act responsibly to ensure my own safety & the safety of others in the work area.

I AGREE TO:

1. Never work in the shop without my faculty's/ Instructor's supervision.
2. Read and practice all the safety regulations that have been distributed to me in this course or have been posted in the work areas.
3. Act in a responsible manner at all times in the laboratory.
4. Follow all instructions given by the faculty/Instructor.
5. Immediately report any unsafe condition or activity to my faculty/Instructor.
6. Wear eye protection at all times when working with tools or working anywhere near someone who is using tools.
7. Cut or Tie back long hair, remove jewellery, secure loosed clothing, and wear boiler suit & safety shoes in the laboratory.
8. Clean all work areas and put equipment away before leaving the laboratory.

I, _____, have read and agree with all the safety instructions.



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Particulars:

Programme : _____

Batch No. : _____

Enrolment No.: _____

Student Signature
