

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM****COURSE TITLE: INSTRUMENTATION CONTROL & QUALITY ASSURANCE****(Code: 3345501)**

Diploma Programme in which this course is offered	Semester in which offered
Fabrication Technology	4 th Semester

1. 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 in mechanical & process industries and knowledge about automatic control in process industries. As you know the exact and precise measurements are the basic need of the manufacturing industries. This course of Instrumentation Control & Quality Assurance, therefore, provides necessary knowledge and skills for accurate & precise measurements for manufacturing and creates quality consciousness, and for use of modern tools & techniques of quality assurance.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills so that students are able to acquire following competency:

- **Measure and gauge various parameters in fabrication industry such as linear dimensions, angular, thread, roughness, straightness, flatness, pressure, temperature, flow etc using analog and digital based instruments to maintain quality as per standards.**

3. COURSE OUTCOMES (CO's)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Measure dimensions of a given job by using relevant linear and angular analog /digital measuring instruments applicable in fabrication industry.
- Prepare inspection plan for given process equipment.
- Apply quality control measures in fabrication industry.
- Apply techniques of quality assurance in fabrication industry.
- Calibrate given linear measuring instrument

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
4	-	2	C	ESE	PA	ESE	PA	
			6	70	30	20	30	150

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;; ESE - End Semester Examination; PA - Progressive Assessment.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Basics of Measurement in Industries	1a. Describe objectives of metrology 1b. Describe static characteristics of measuring instrument	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 assembling 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 Limit gauges & weld gauge
Unit – II Linear Measurement	2a. Select suitable linear measuring instruments and check for errors. 2b. Calibrate given linear measuring instrument	2.1 Direct and indirect measuring instruments 2.2 Construction, working principle, least count of various linear measuring instruments. 2.3 Errors in measurements 2.4 Working and use of dial indicator. 2.5 Selection of measuring instrument. 2.6 Straightness, flatness, squareness and roundness measurement 2.7 Calibration of measuring instrument vernier calliper & micrometer
Unit – III Angular Measurement	3A. Describe working principle and calculate least count of angular	3.1 Construction, working principle, least count of various angular measuring instruments.

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
	measuring instruments. 3b. Select suitable angular measuring instruments and measure dimensions of a given job.	3.2 Optical angular measuring instruments, clinometers, auto collimator, angle dekker etc.
Unit – IV Surface Roughness Measurement	4a. Define various terms related with surface roughness. 4b. Measure surface roughness and compute profile by using given data.	4.1 Surface roughness terminology 4.2 Direct and indirect surface roughness measuring system 4.3 measurement of surface roughness and computation of profile 4.4 Relationship of machining process and surface texture
Unit– V Instrumentation Control In Process Industries	5a. Explain instruments used in process industries and various transducers and sensors. 5b. Describe automatic control system 5c. Select and measure the temperature, pressure and flow by using appropriate measuring devices. 5d. Calibrate pressure and temperature measuring devices	5.1 Transducer 5.2 Temperature measurement 5.3 Pressure measurement 5.4 Flow measurement 5.5 Automatic control 5.6 Calibration of pressure gauge, temperature measuring device
Unit– VI Inspection	6a. Explain roles, responsibilities and ethical requirement of welding / fabrication industry inspector. 6b. Develop qualities of good inspector for fabrication industry 6c. Carryout inspection of process / fabrication equipment	6.1 Need of inspection in industry 6.2 Types of inspection 6.3 Centralized and decentralized inspection system 6.4 Profile of inspector for fabrication industry 6.5 Ethical and essential requirement of welding inspector 6.6 Responsibilities of welding inspector 6.7 Inspection of process equipment 6.8 Welding inspection operation 6.9 Role of third party inspection agencies in field of fabrication
Unit– VII Quality Control	7a. Describe the importance and application of quality control system	7.1 Meaning of quality 7.2 Quality of design 7.3 Quality of conformance

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
	fabrication industry	7.4 Quality of performance 7.5 Quality control 7.6 Quality characteristics 7.7 Cost of quality 7.8 Cost of prevention 7.9 Cost of appraisal 7.10 Cost of internal & external failure 7.11 Quality Control & Inspection 7.12 Quality policy
Unit- VIII Modern Tools & Techniques for Quality Assurance	8a. Select and use suitable modern tools and techniques for quality assurance.	8.1 Concept, principle, procedure and application of 1. TQM, 2. ISO 9000, 3. 5S 4. Quality Circle 5. Zero Defect 6. Six Sigma 7. Kaizen 8. Benchmarking 9. Kanban 10. JIT 11. PokaYoke

6 SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	Basics of Measurement in Industries	6	4	4	0	8
2	Linear Measurement	8	0	8	4	12
3	Angular Measurement	6	0	4	4	8
4	Surface Roughness Measurement	4	3	3	0	6
5	Instrumentation Control in Process Industries	10	4	5	5	14
6	Inspection	4	0	3	3	6
7	Quality Control	4	3	3	0	6
8	Modern Tools & Techniques For Quality Assurance	6	4	3	3	10

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
	Total	56	18	33	19	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7 SUGGESTED LIST OF EXERCISE/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (outcome in psychomotor domain)	Approx. Hrs. Required
1	02	Measure Length of given job using Vernier Caliper	2
2	02	Measure OD of given job using Vernier Caliper	2
3	02	Measure ID of given job using Vernier Caliper	2
4	02	Measure Depth of blind hole of given job using Vernier Calliper	4
5	02	Measure OD of given job using Outside Micrometer	2
6	02	Compare Vernier Caliper and Digital Vernier Micrometer	2
7	02	Prepare set of Slip Gauges for given dimension using M112 slip gauge set	2
8	02	Prepare set of Angle Gauges for given angle using angle gauge set	2
9	02	Measure angle of given job using Universal Bevel Protector	2
10	04	Measure Straightness, Flatness and Roundness of given job using dial gauge / spirit level.	2
11	01	Calibrate Vernier caliper and micrometer screw	2
12	06	Prepare inspection report of Process Equipment	4
		Total	28

8 SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities:

- i. Prepare sketchbook of drawing of various measuring instrument
- ii. Ten minutes power point presentation from the topic of syllabus and beyond the syllabus
- iii. Report writing on various topics from syllabus and beyond syllabus

9. SUGGESTED INSTRUCTIONAL STRATEGIES (If Any)

- i. Arrange visit to industries to show the use of instruments, control systems and quality assurance mechanisms.
- ii. Show Video/animation films, photographs for explaining working principles of instruments.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Title of Books	Author	Publication
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
4	Mechanical measurement	Dr. D. S. Kumar	
5	Mechanical measurement	R. K. Jain	Khanna publishers
6	Statistical Quality Control	M. Mahajan	Dhanpat rai & co.

B. List of Major Equipment/ Instrument

- i. Surface plate, 500 x 500 mm.
- ii. Vernier calliper, 100 to 200mm, least count 0.01mm.
- iii. Vernier calliper, 100 to 200mm, least count 0.01mm, digital.
- iv. Inside micrometers, least count 0.01mm, 0-25mm, 25-50mm, 50-75mm.
- v. Outside micrometer, least count 0.01mm, 0-25mm, 25-50mm, 50-75mm.
- vi. Outside micrometer, least count 0.001mm, 0-25mm.
- vii. Height gauge- 300mm with least count 0.01mm.
- viii. Depth gauge- 100 mm with least count 0.01mm.
- ix. Slip gauge set M112/1

- x. Angle gauge set
- xi. Dead weight piston gauge
- xii. Bevel protector
- xiii. Straight edge, 500mm.
- xiv. Feeler gauge, radius gauge, thread pitch gauge.
- xv. Dial indicators least count 0.01mm.with magnetic stand.
- xvi. Microprocessor- stylus-probe based surface roughness testing machine.
- xvii. Microscope to compare various textures and surface roughness.
- xviii. Thread micrometers.
- xix. Sprit level

C. List of software/ learning websites:

- i. www.technologystudent.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. P. B. Pathak**, Convener & HOD, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. B. K. Gandhi**, Sr. Lecturer, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. S. Y. Merchant**, Sr. Lecturer, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. A. K. Sarathe**, Associate Professor Department of Mechanical Engineering.
- **Dr K .K. Jain**, Dean and Professor, Department of Mechanical Engineering