

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS ENGINEERING (20)

METROLOGY AND PRODUCT ENGINEERING

SUBJECT CODE: 2162007

B.E. 6th Semester

Type of course: Engineering Science (Departmental Elective - I)

Prerequisite: N.A.

Rationale: This subject is useful to understand the aspects of measuring and gauging using various equipments / instruments for quality control. Concepts of product analysis such as dimensioning, manufacturability and cost analysis for new product development help student to imagine actual shop floor activities.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction Accuracy of measurement, types and errors of measurement.	3	7%
2	Linear and Angular Measurement Line standard and end standard, slip gauges, length bars, principle of alignments, magnification, accuracy and precision, various comparators (mechanical, optical, pneumatic, electrical), sine bar, measurement of taper gauges, autocollimator, circular division, squareness measurement.	7	17%
3	Limit and Limit Gauges Selective assembly, system of limits and fits, design of limit gauges including gauge tolerance and wear allowance, Taylor's theory of gauging, taper limit gauges, gauging of large diameters, gauge materials and its requirements.	7	17%
4	Machine Tool Metrology Alignment test for all conventional machine tools, straightness and flatness measurement, flatness of small surface area using principle of interferometry, roundness measurement, concepts of calibration, Coordinate measuring machine (Construction features, working and applications).	7	17%
5	Gear and Screw Thread Measurement Standard definitions, Gear tooth thickness measurement, measurements over rollers, thread measurement (measurement of major, minor and effective diameter), measurement of thread form, types of pitch errors.	6	15%
6	Surface Texture Methods of measuring surface texture, Analysis of surface traces,	2	5%

	interference microscope.		
7	Concept of Product Engineering Conceptual framework, Product life cycle, product research and development, product analysis (concept of bill of material and assembly process chart), classifying operations (basic, principal and supporting operations), producibility criteria, concept of tolerance analysis, cost analysis (types of cost, depreciation, salvage).	6	15%
8	Statistical quality control Process variability, standard deviation, control charts, characteristics of sampling systems.	3	7%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	20	15	15	10	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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.

Reference Books:

1. Metrology for Engineers, J.F.W. Galyer and C.R. Shotbolt, ELBS
2. Practical Engineering Metrology, K.W.B. Sharp
3. Principles of Engineering Production, A.J. Lissaman and S.J. Martin
4. Workshop Technology, Part-I,II,III, W.A.J. Chapman and S.J. Martin, Viva Publication. McGraw Hill Publication
5. Process Engineering: for Manufacturing, D.F. Eary and G.E. Johnson, Printice Hall College div.
6. Design for Manufacturability, James G. Bralla, McGraw Hill
7. Product Design and Value Engineering, H.R. Thakkar, M.A. Bulsara, Charotar Publishing House Pvt. Ltd.

Course Outcome:

After learning the course the students should be able to:

1. Identify the engineering tools and equipments available on shop floor of industry for the purpose of measuring and gauging.
2. Forecast the costing and manufacturability of a given product design for optimization and quality control.
3. Judge the role played by Mechatronics engineers to automate the process of quality control by integrating the knowledge of multidisciplinary engineering branches.

List of Experiments:

1. Study of basic instruments available in Metrology Lab
2. Linear and angular measurement of standard components
3. Performance measurement of gear tooth thickness and height measurement

4. Screw thread measurement using floating carriage micrometer
5. Straightness measurement of lathe guide ways
6. Flatness measurement of surface plate
7. Height comparison using principle of interferometry
8. Process capability study
9. Part print analysis
10. Cost analysis
11. Design for manufacturing

Design based Problems (DP)/Open Ended Problem:

Student may be given a task to exhibit their knowledge of the course studied during the academic year.

Major Equipment:

1. All kinds of conventional machine tools are useful for study purpose.
2. Floating carriage micro meter
3. Measuring and Gauging instruments such as vernier caliper, vernier gear tooth caliper, micro meter, bevel protractor, spirit level, interferometer, etc.
4. Profile projector and engineering microscope

List of Open Source Software/learning website:

The website of NPTL may be utilized for additional learning.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.