# GUJARAT TECHNOLOGICAL UNIVERSITY

**MECHANICAL (ADVANCE MANUFACTURING SYSTEM) (50)**
METROLOGY AND COMPUTER AIDED INSPECTION
**SUBJECT CODE:** 2735004
M.E. 3rd SEMESTER

**Type of course:** Engineering Science

**Prerequisite:** No Prerequisite

**Rationale:** The purpose of this course is to teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries. This will also make the students capable of learning to operate and use advanced metrological devices with ease in industrial environments.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | | | |
| L | T | P | C | ESE (E) | PA (M) | ESE (V) | | PA (I) | | |
| | | | | | | ESE | OEP | PA | RP | |
| 3 | 2# | 2 | 5 | 70 | 30 | 20 | 10 | 10 | 10 | 150 |

**Content:**

| Sr. No. | Contents | Total Hrs. | % Weightage |
|---|---|---|---|
| 1 | **Concepts of Metrology:** Terminologies, Standards of measurement, Errors in measurement, Interchangeability and Selective assembly, Accuracy and Precision, Calibration of instruments, Basics of Dimensional metrology and Form metrology | 3 | 5% |
| 2 | **Measurement of Surface Roughness:** Definitions, Types of Surface Texture: Surface Roughness Measurement Methods, Comparison, Contact and Non-Contact type roughness measuring devices, 3D Surface Roughness Measurement, Nano Level Surface Roughness Measurement, Instruments. | 10 | 25% |
| 3 | **Interferometry:** Introduction, Principles of light interference, Interferometers, Measurement and Calibration, Laser Interferometry. | 10 | 25% |
| 4 | **Computer Aided and Laser Metrology:** Tool Makers Microscope, Microhite, Coordinate Measuring Machines, Applications, Laser Micrometer, Laser Scanning gauge, Computer Aided Inspection techniques, In-process inspection, Machine Vision system-Applications. | 10 | 25% |
| 5 | **Image Processing for Metrology:** Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image | 9 | 20% |

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|---|---|---|---|
| | Transforms - Examples. | | |

**References:**


1. Gupta, I.C., "A Text Book of engineering metrology", Dhanpat Rai and Sons, 1996.
2. Jain ,R.K.,"Engineering Metrology", Khanna Publishers, 2008.
3. Bewoor, A.K. and Kulkarni,V.A.,"Metrology and Measurement", Tata Mc Graw-Hill, 2009.
4. Galyer, F.W. and Shotbolt, C.R., "Metrology for engineers", ELBS, 1990.
5. Smith,G.T., "Industrial Metrology", Springer, 2002
6. Whitehouse,D.J., "Surface and their measurement", Hermes Penton Ltd, 2004.
7. "ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
8. Rajput,R.K., "Engineering Metrology and Instrumentations", Kataria & Sons Publishers, 2001.
9. Sonka,M., Hlavac,V. and Boyle.R., "Image Processing, Analysis, and Machine Vision", Cengage-Engineering, 2007.


**Course Outcome:**

Students will:

1. Understand the advanced measurement principles with ease.
2. Operate sophisticated measurement and inspection facilities.
3. Design and develop new measuring methods.

**List of Experiments:**

1. Exercises on grinding and surface measurement
2. Measurements in Universal Measuring Microscope, Profile Projector, and with various advanced instruments
3. Flatness measurement using autocollimator
4. Programming and measurements with CNC Coordinate Measuring Machine, Surface texture analysis.
5. Linear and Angular measurements using Autocollimator.
6. Measurement of tooth thickness using gear tooth Vernier calliper
7. Calibration of optical comparator and measurement of dimensions
8. Exercises in Digital Height Gauge.
9. Measurement of Taper Angle using sine bar.
10. Measurement of components using profile projectors.
11. Study Exercises in Video measuring system, Rolling gear tester, Surface Roughness Tester and CMMs

**Design based Problems (DP)/Open Ended Problem:**

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.