

ENGINEERING METROLOGY

Course Code: 13ME1123

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Course Educational Objectives:

To make the student

- ❖ Understand systems of limits and fits
- ❖ Study the basic principles of different measuring instruments.
- ❖ Learn how to measure surface roughness of the surface
- ❖ Understand machine tool alignment tests

Course Outcomes:

The student will be able to

- ❖ Become aware of existing systems of limits and fits.
- ❖ Explain the theory of linear and angular measurements
- ❖ Know various types of measuring instruments and surface roughness measuring methods
- ❖ Explain machine tool alignment tests

UNIT-I

(14 Lectures)

SYSTEMS OF LIMITS AND FITS:

Introduction, nominal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – British standard system, International standard system for plain and screwed work.

LIMIT GAUGES:

Taylor's principle – Design of GO and NO GO gauges, plug, ring, snap, gap, taper, profile and position gauges.

UNIT-II**(10 Lectures)****LINEAR MEASUREMENT:**

Length standard, line and end standards, slip gauges – calibration of the slip gauges, dial indicator, micrometers.

Measurement of angles and tapers: Different methods – bevel protractor – angle slip gauges – spirit levels– sine bar – sine plate, rollers and spheres

UNIT-III**(12 Lectures)****FLAT SURFACE MEASUREMENT:**

Measurement of flat surfaces – instruments used – straight edges– surface plates – optical flat and auto collimator.

OPTICAL MEASURING INSTRUMENTS:

Tool maker's microscope and its uses, collimators, optical projector, optical flats and their uses, interferometer.

SURFACE ROUGHNESS MEASUREMENT:

Differences between surface roughness and surface waviness-numerical assessment of surface finish– CLA, R.M.S Values , Rz values, methods of measurement of surface finish-Tomlinson's surface meter, profilograph, Talysurf, ISI symbols for indication of surface finish.

UNIT-IV**(12 Lectures)****SCREW THREAD MEASUREMENT:**

Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.

Measurement through comparators: Comparators – Mechanical, Electrical and Electronic comparators, pneumatic comparators and their uses in mass production.

GEAR MEASUREMENT:

Gear measuring instruments, gear tooth profile measurement, measurement of diameter, pitch, pressure angle and tooth thickness.

UNIT-V**(12 Lectures)****MACHINE TOOL ALIGNMENT TESTS:**

Alignment tests on lathe, milling, drilling machine tools, coordinate measuring

machine (CMM): Types of CMM, Role of CMM, and applications of CMM.

Computer aided quality control: Terminology in quality control, computer in quality control, contact inspection methods, noncontact inspection methods.

TEXT BOOKS:

1. I C Gupta, “*Engineering Metrology*”, 5th Edition, Danapath Rai & Co, 2008.
2. P.N.Rao, “*CAD/CAM Principles and Applications*”. 2nd Edition, 2008.

REFERENCES:

1. R.K. Jain, “*Engineering Metrology*”. 20th Edition, Khanna Publishers, 2007.
2. M. Mahajan, “*Engineering Metrology*”, Dhanapati Rai publications, 2007.
3. BIS standards on Limits & Fits (IS 919), Surface Finish (IS 2073), Machine Tool Alignment, 1993.

