

**III Year II Semester**

**L T P C**

**Code: 20ME6012**

**3 0 0 3**

### **METROLOGY & INSTRUMENTATION AND CONTROL SYSTEMS**

#### **Course Objectives:**

The Students will acquire the knowledge

1. To interpret the principles of different types of limits and fits and explain the operating principles of linear measurements. (BL-2)
2. To illustrate the measurement of surface roughness.
3. To illustrate the concepts of gear, screw thread and flatness measurements and alignment of machine tools.
4. To illustrate the basic concepts of instrumentation and working of various sensors and transducers.
5. To illustrate measurement methods of various quantities.

#### **UNIT-I SYSTEMS OF LIMITS AND FITS**

Introduction, nominal size, tolerance, limits, deviations, fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, deterministic & statistical tolerances, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning.

LINEAR MEASUREMENT: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micro metres.

MEASUREMENT OF ANGLES AND TAPERS: Different methods-bevel protractor, angle slip gauges - angle dekkor – spirit levels – sine bar - sine table, rollers and spheres used to measure angles and tapers. LIMIT GAUGES: Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

#### **UNIT-II SURFACE ROUGHNESS MEASUREMENT**

Differences between surface roughness and surface waviness -Numerical assessment of surface finish - CLA, Rt., R.M.S. Rz,R10 values, Method of measurement of surface finish - Profilograph, Talysurf, ISI symbols for indication of surface finish.

COMPARATORS: Types -mechanical, optical, electrical and electronic, pneumatic comparators and their uses.

#### **UNIT-III GEAR MEASUREMENT:**

Nomenclature of gear tooth, tooth thickness measurement with gear tooth vernier & flange micro meter, pitch measurement, total composite error and tooth to tooth composite errors, rolling gear tester, in involute profile checking.

SCREW THREAD MEASUREMENT: Elements of measurement - errors in screw threads- concept of virtual effective diameter, measurement of effective diameter, angle of thread and thread pitch, and profile thread gauges.

FLATNESS MEASUREMENT:

Measurement of flatness of surfaces- instruments used- straight edges- surface plates - auto collimator.

MACHINE TOOL ALIGNMENT TESTS: Principles of machine tool alignment testing on lathe, drilling and milling machines.

#### **UNIT-IV MECHANICAL INSTRUMENTATION AND INSTRUMENTS**

Generalized measurement system and its functional elements, primary, secondary and working standards. Instrument characteristics, static and dynamic characteristics classification – zero, first and second order instruments and responses, problems. Sensors and transducers – mechanical detector – transducer elements, electrical transducers – Thermo electric transducer – variable inductance transducers – capacitor transducers – preamplifiers – charge amplifiers – Piezo electric transducers – strain gauges – bridge circuits (quarter, half and full activated)

#### **UNIT-V MEASUREMENT SYSTEMS**

Force measurement – Torque measurement – Pressure measurement – Flow measurement– Temperature measurement – Vibration Measurement.

#### **TEXT BOOKS:**

1. Engineering Metrology / R.K. Jain / Khanna Publishers
2. Manufacturing Processes / JP Kaushish / PHI Publishers-2<sup>nd</sup> Edition
3. Manufacturing Technology Vol-II / P.N Rao / Tata McGraw Hill
4. Mechanical Measurement and Control – Metropolitan Book company Pvt.Ltd.– 1989

#### **Reference Books:**

1. Engineering Metrology / Mahajan / Dhanpat Rai Publishers
2. Engineering Metrology / I.C.Gupta / Dhanpat Rai Publishers

#### **Course Outcomes:**

Upon successful completion of this course, the students will be able to:

1. To illustrate the principles of different types of limits and fits and explain the operating principles of linear measurements. (BL-2)
2. To demonstrate the measurement of surface roughness.
3. To explain the concepts of gear, screw thread and flatness measurements and alignment of machine tools.
4. To explain the basic concepts of instrumentation and working of various sensors and transducers.
5. To choose the right measurement method for various quantities.