III B. TECH - I SEMESTER
ENGINEERING METROLOGY

Course Code: ME5T4 **Credits: 3**
Lecture: 3 Periods/week **Internal assessment: 30 Marks**
Tutorial: 1 Period/week **Semester end examination: 70 Marks**

COURSE OBJECTIVES:

- Demonstrate the concept of limits, fits, tolerance and dimensional standard systems.
- Know the working principle of different instruments to measure length, angle, flatness, surface roughness, elements of threads and gears
- Identify the need of comparators and machine tool alignment tests.

COURSE OUTCOMES:

At the end of course the students will be able to:

1. Describe limits, fits, tolerance, Hole and Shaft basis systems and standard systems.
2. Demonstrate the principles of linear and angular measurement, Taylor's principle for the design of Go & No Go gauges.
3. Discuss the construction and working of optical measuring instruments, methods used to estimate flatness and surface roughness.
4. Describe different elements of Gear and Screw thread and their measurement.
5. Illustrate different comparators and Machine tool alignment tests.

Pre-Requisites:

Engineering Physics, Production Technology, Metal cutting and Machine tools

UNIT I

SYSTEMS OF LIMITS AND FITS:

Introduction, Nominal Size, Tolerance, Limits, Deviations, Fits and their types – Unilateral and Bilateral tolerance system, Hole and Shaft basis systems – Interchangeability,
Selective assembly. British standard system, International Standard System, Application of Limits and Tolerances for correct functioning.

UNIT II

LINEAR MEASUREMENT:

Line standards, End standards, wavelength standards, slip gauges, calibration of slip gauges, Dial indicators, Micrometers.

MEASUREMENT OF ANGLES AND TAPERS: Different methods – Bevel protractor,
Angle gauges –Clinometer-Angle dekkor- Spirit levels – Sine bar – Sine table, Rollers
and Spheres used to determine the tapers.

LIMIT GAUGES: Taylor's principle – design of Go and No Go gauges, Plug, Ring, Snap, Gap, Taper, Profile and Position gauges.

UNIT III

OPTICAL MEASURING INSTRUMENTS:

Tool maker's microscope and uses – Collimators, Optical projector, Optical flats and their uses

INTERFEROMETRY: Interference of light, Michaleson's interferometer, NPL flatness interferometer and NPL gauge interferometer.

FLATSURFACE MEASUREMENT: Measurement of flat surfaces – instruments used – Straight edges – Surface plates – Auto collimator.

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.

UNIT IV
GEAR MEASUREMENT:
Nomenclature of gear tooth, tooth thickness measurement with Gear tooth Vernier and Flange micrometer, Pitch measurement, Total composite error and Tooth to tooth composite errors, Rolling gear tester, Involute profile checking.
SCREWTHREAD 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.

UNIT V
COMPARATORS:
Types- Mechanical, optical, electrical and electronic, pneumatic comparators and their uses.
MACHINE TOOL ALIGNMENT TESTS:
Machine Tool Alignment Test on lathe, drilling and milling machines.

Learning Resources

Text Books:
1. A Textbook of Engineering Metrology, by I.C.Gupta, Danpath Rai Publications, 7th Edition
2. A Textbook of Metrology, by M. Mahajan, DanpathRai Publications,

Reference Books:
1. Engineering Metrology, by R.K. Jain, Khanna Publishers
2. Precision Engineering in Manufacturing, by R.L.Murthy, New Age Publications
3.Metrology for Engineers, by J.F.W. Galyer , Charles Reginald Shotbolt, Cengage Learning EMEA; 5th edition