METROLOGY LABORATORY - EXPERIMENTS FOR S4PM 2008

(Updated 4/1/08)

General instructions:

1. All measured values should be noted in rough record and got attested and valued by the Faculty before leaving the Lab. To be submitted at end of semester. Will carry 20% weighting for marks.
2. The fair record should be brought in the subsequent class positively. 20% weighting for marks. Photocopying of figures is not permitted.
3. 20% marks will be for a viva in each class based on the experiment of the previous class / quiz at the end of each cycle.
4. A final exam at the end of the semester will determine the remaining 40% marks.
5. Identify the least count, range etc of all equipment used and mention in the records.
6. "Study" requires making a schematic sketch of the equipment roughly in rough record and neatly in fair record. Brief working to be explained in fair record.
7. Calibration -Take readings in random order (Two replications randomized in two blocks) unless otherwise mentioned. Calibration equations should be determined by the method of least squares. Use of calculator is permitted. Quantify the calibration uncertainty with 95% confidence, neglecting the uncertainty in the input. Plot the correction graph, unless otherwise mentioned.
8. Discuss the sources of uncertainties in each measurement and write in fair record.
9. All rust prone equipment should be cleaned and petroleum jelly applied before their return.
10. Do **not** apply excessive force on any equipment. If any resistance to movement is felt, please request for assistance.

CYCLE I

Batch 1

Screw Thread Measurements

1) Examine the difference in fit between the nut and various screws.
2) Study the *Universal Measuring Microscope*. Measure Effective dia, Major dia, Minor dia, Thread angle, and Pitch of given screw thread.
3) Determine the Effective dia of given screw thread using *Three Wire Sets* (demonstration)
4) Measure the Effective dia of given screw thread using *Thread Pitch Micrometer*
5) Study the *Thread Pitch Gauge*, determine Nominal Pitch of given thread

Batch 2

6) Study the principle of *Autocollimator*, determine straightness error along a line on the surface plate, plot a graph representing the surface.
7) Study the *Spirit level* – determine straightness along a line, compare with autocollimator result.
8) Measure the WBT of the room using *sling psychrometer* and determine the humidity using standard psychrometric chart.

Batch 3

9) Calibrate given pressure gauge using *Dead Weight Pressure Gauge Tester*. What is the correct pressure if the gauge reads ____?
10) Study the mechanism of a *Dial Gauge*. Study the *Dial Gauge calibrator* and calibrate the given dial gauge. Compare sequential vs random loading. The total number of readings should be the same in either case. What is the correct reading if the dial reads _____?

Batch 4

11) Height Measuring Device (LVDT based) – Calibrate, prepare an ordinary calibration plot and compare with correction plot. What is the correct reading if the observed reading is _____?

ID Measurement:

12) Study *slip gauges* and measure the diameter of the given ring with the help of rollers. Use rule of halves.
13) Study *three pin micrometer* and measure the diameter of the given ring.

14) Study *bore dial gauge* and measure the diameter of the given ring.
15) Measure the diameter of the given ring using balls.

Batch 5

16) Study *resistance strain gauges*, Strain Gauge Load Cell: Compare the outputs from different bridge arrangements for one load, Choose ___ bridge arrangement and determine the stress strain relationship, Plot stress strain graph, Determine modulus of elasticity.
17) Study the Ultrasonic Flaw Detecting equipment. Sketch the screen views with no defect and defect detected.

CYCLE II

Batch 1

Gear measurements:

18) *Profile Projector* – Study the optical path, Measure Base Pitch, Outer Dia using Double Image method, determine parameters
19) *Profile error* using Profile Projector – Trace the profile of one tooth on tracing sheet. (Use magnification 20:1). Draw the theoretical involute profile of one tooth on graph sheet, compare with traced profile, and determine profile error.
20) Study the *Disc Micrometer*, measure Base Tangent Length of given gear and determine tooth thickness.

Batch 2

21) Study the *Tool Maker's Microscope* and measure tool angles in ASA system, including rake angle. Also measure the indirect angles using the digital dial gauge.
22) Study *Optical flat*, determine the parallelism error between micrometer faces.
23) Study the *Combination set*, determine the angle of the given V.

Batch 3

24) Thermocouple: Verify the law of intermediate temperatures. Ice to be arranged.
25) Calibrate the given thermocouple using constant temperature bath apparatus. Compare with the standard calibration equation. Plot ordinary calibration plot.
26) Determine the time constant of the given thermistor using the PC based Data acquisition system. Plot Temp vs Time, ln(error fraction vs time).

Batch 4

27) Carry out an *R&R* study between observers - Measure batch of balls, analyse.
28) Study the *Gear Tooth vernier* and Measure Tooth thickness of given gear
29) Measure the gear over rollers and compare with standard value
30) Study the *Feeler Gauge*, measure the given gap.

Batch 5

31) Study the *surface profilometer* (demonstration), compare the values from lapping, grinding, milling and turning operations.
32) Study the *Planimeter.* Measure area of given irregular figure
33) Study the *Coordinate Measuring Machine* (demonstration). Measure a ring at two temperatures and compare results.
34) Determine the *class of fits* between given shafts and hole.