

2013 ME3104 Metrology And Computer Aided Inspection – Test 2

Max. Marks: 20

Approved tables are permitted

Time: 60 minutes

All questions carry 2 marks each unless otherwise mentioned. Approved tables will be provided.

1. Three dry cells showed an open circuit voltage of 1.4, 1.5 and 1.55 V respectively, when measured using the same voltmeter and the standard uncertainty of each reading is estimated to be 0.05 V. Determine the standard uncertainty of a battery consisting of the three cells in series. Explain the logic.
2. The mass of an object is calculated as 24.39786 kg with standard uncertainty 0.0858 kg. Express the result with the recommended number of decimal places, explaining the rule involved.
3. A sensor which behaves as a first order system is required to measure an oscillating temperature of maximum frequency 20 Hz. What is the maximum allowable time constant if an inaccuracy of 3 % is allowed?
4. Sketch and explain the variation of magnitude ratio with input signal frequency on a second order system.
5. Sketch and dimension a plug gauge for measuring the bore $40+0.09$ mm. Use unilateral tolerance with wear allowance.
6. Explain the physics behind the phenomenon of wringing of gauge blocks
7. Determine the true size of a gauge block of nominal size 16.5 mm, which gave the following results after calibration:

Colour	Radiation wavelength (μm)	Observed fraction
Red	0.6438	0.62
Green	0.5086	0.59
Blue	0.4800	0.63
Violet	0.4678	0.62

(4 marks)

8. What is the importance of lay in Surface Roughness measurement?
9. Explain Bearing Ratio Curve and its importance.

SOLUTION TO NUMERICAL PROBLEMS:

1. 0.15 V

2. (24.398 +/- 0.086)

3.

$$M(\omega) = 0.97$$

$$1/[1+(\omega\tau)^2]^{0.5} = 0.97$$

$$\omega\tau = 0.0628$$

$$\omega = 2\pi(20) = 125.6637 \text{ rad/s}$$

$$\tau = 0.005 \text{ s}$$

7. 16500.15 um