Name:……………   Roll No.:……………

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
Department of Mechanical Engineering
End Sem Examination, November 2013
V Semester B.Tech. – Production Engineering
ME3104 METROLOGY AND COMPUTER AIDED INSPECTION

Time: Three hours   Maximum Marks: 50

All questions carry 2 marks each, unless mentioned otherwise.
Approved tables permitted

1. Define the terms "Measured quantity value" and "Reference quantity value" according to VIM 2008 and differentiate.
2. Explain the historical developments in the definition of the metre.
3. Show how one factor at a time experiments may not be able to detect interactions.
4. Determine a 95% expanded uncertainty interval for the critical buckling load of a simply supported column given by Euler's formula as $F = \dfrac{\pi^2 EI}{l^2}$. E is the modulus of elasticity of the material, obtained as 210 GPa from a handbook, and it is mentioned that the 95% uncertainty is 5 GPa. I, the moment of inertia of the cross section is calculated as $I = \pi \dfrac{d^4}{64}$, where d is the diameter of the column, which was obtained as 2.12 mm using a vernier of least count 0.01 mm and repeated measurements showed the same reading. The length of the column was measured several times and the readings were 992, 1002, 1006, 998, 1004 mm.

    (3+4+2=9 marks)
5. Three capacitors showed capacitance values of 3, 3.5 and 4.5 uF respectively, when measured using the same capacitance meter and the standard uncertainty of each reading is estimated to be 0.2 uF. Determine the standard uncertainty of of the three capacitors if connected in parallel, with reasons.
6. The strength of a weld joint is specified as 200 MPa min. A sample joint was tested and its strength found to be 205 +/- 8 MPa (95%). Is the sample acceptable if stringent acceptance is followed, for a guard band of a) 100%, b) 50%. Give reasons.
7. A thermometer with time constant 5 s and kept at a room temperature of 40 °C is dipped into a fluid of temperature 70 °C. Determine the temperature indicated by the thermometer after 15 s.
8. What are adjustable snap gauges? Explain their use.
9. Determine the true size of a gauge block of nominal size 12.2 mm, which gave the following results after calibration:

Colour	Radiation wavelength (μm)	Observed fraction
Red	0.6438	0.43
Green	0.5086	0.42
Blue	0.4800	0.96
Violet	0.4678	0.68

    (4 marks)
10. What are the optical methods of surface roughness measurement? Distinguish between them.
11. The data from a stylus type profilometer is given below. Determine Ra.

Sl No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
x (mm)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
y' (um)	3	7	12	8	4	7	11	3	2	5	10	7	2	5	9	7	2	9	4	3

12. What is the problem with datum precedence in conventional tolerancing vis-a-vis GD&T?
13. Determine straightness error with respect to the end-point line for the data, (100,3), (200,7), (300,4), (400,5), (500,2), (600,6), where the first coordinate is the x distance in mm, while the second coordinate is the deviation from a straight line in um.

    (3 marks)
14. Sketch how the geometrical tolerance "co-axiality" is indicated and explain how it is measured.
15. Why is a fixed bridge type CMM more accurate than a moving bridge type?
16. Sketch the stylus used in a CMM and explain Effective Working Length.
17. Explain the sequence of steps while measuring on object using a CMM.
18. What is structured lighting? What are its uses?
19. Differentiate between CMOS and CCD sensors.
20. Explain the two strategies used in file compression.
21. Explain any one method of edge detection.
22. a) Give one good point about this course b) Give one suggestion which you think will best improve this course.