Name:…………..   Roll No.:……………

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
Department of Mechanical Engineering
End Sem Examination, April 2013
VI Semester B.Tech. – Mechanical Engineering

ME3112 METROLOGY AND INSTRUMENTATION

Time: Three hours   **Maximum Marks: 50**
All questions carry 2 marks each, unless mentioned otherwise.
Approved tables permitted

1. Define the terms calibration and traceability according to VIM 2008 and explain the relationship between them.

    (3 marks)

2. What are the two major proposals for the redefinition of the kilogram?

3. What is the actual diameter if the apparent diameter is 21.24 mm while measuring a shaft with the micrometer misaligned by an angle of 1 degree? The anvil of the micrometer has a diameter of 6 mm.

4. The effective diameter of a screw thread is given by $D_E = W - [d*(cosec\ q + 1) - (p/2)*cot\ q]$, where W is the measurement over wires, d is the diameter of a single wire, p the pitch of the thread and q the semi thread angle. The thread angle is 60° uniformly distributed between +/-1°. The diameter of the wires is obtained from a test certificate as 0.878 mm with a 99% expanded uncertainty of +/-0.01 mm. The pitch of the screw is known to be 1.5 mm, triangularly distributed between +/- 0.02 mm The diameter over wires was measured several times with the results: 24.14, 24.21, 24.27, 24.26, 24.44 and 24.31 mm. Determine a 90% expanded uncertainty for the effective diameter.

    (3+4+2=9 marks)

5. Ram, Gopal and Krishna were weighed in the same weighing machine, within a short period of time, and found to be 55, 65 and 60 kg respectively. The standard uncertainty of each reading of the weighing machine is 1.5 kg. If all three are to travel by an aircraft, what will be the total payload due to their weight and associated uncertainty? Explain.

6. The compressive strength of concrete two days after pouring is specified as 15 kg/cm^2 minimum. A sample was tested and found to be (15.3 +/- 0.4) (95%). Is the sample acceptable at relaxed acceptance with guard band of a) 100 % b) 50% ?

7. Correlation is not causation. Explain the occasion and significance of this statement.

8. Explain the various stages of an experiment with reference to the type of designs chosen at each stage.

9. What are the requirements of good experimental designs?

10. Explain the effect of the cut-off value selected on the value of Ra calulated from a profile.

11. Distinguish between the surface roughness parameters Ra and Sa.

12. Explain with a neat sketch the construction and working of Johansson Mikrokator.

    (4 marks)

13. Explain with a neat sketch the construction and working of McLeod Gauge.

    (4 marks)

14. Explain with a neat sketch the construction and working of Solex pneumatic comparator

    (4 marks)

15. A certain pressure transducer has a natural frequency of 4000 Hz and a damping ratio of 0.4. Estimate the resonant frequency and amplitude response and phase shift at frequency of 1000 Hz. (Assume the maximum amplitude ratio for the above system occurs at a frequency ratio of 0.8)

16. What are the laws available for analysis of thermoelectric circuits?

17. Describe the Poisson method in strain measurement.

18. Describe the procedure for wringing of slip gauges.

19. a) Give one good point about this course b) Give one suggestion which you think will best improve this course.

SOLUTIONS TO NUMERICALS:

2.

3. $D = W - d\left(\csc q + 1\right) + \left(p \cot q\right)/2$

4. $c_W = 1$

5. $c_d = -\left(\csc q + 1\right)$

6. $c_p = \cot q / 2$

7. $c_q = d \csc q \cot q - \left(p \csc^2 q\right)/2$