Roll No. | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOVEMBER 2024

MECHANICAL ENGINEERING

5th Semester

ME 7502 & Metrology and Measurements

(Regulation 2015)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Define calibration.
2. What is the effect of using a measurement system which has a large measurement uncertainty?
3. Write the gauge block combination to assemble a dimension of 45.655 using a 46-piece gauge block set which has the following gauge blocks.

   1,001-1,009 mm (1 μm step / 9 blocks)

   1.01-1.09 mm (0.01 mm step / 9 blocks)

   1.1-1.9 mm (0.1 mm step / 9 blocks)

   1-9 mm (1 mm step / 9 blocks)

   10-100 mm (10 mm step / 10 blocks).
4. If the "GO" plug gauge does not pass through the hole being checked, what do you infer about the size of the hole?
5. Write any two advantages of GD&T.
6. What is the difference between sampling length and evaluation length in surface roughness measurement?
7. Write the expression for the best size wire of screw thread.
8. What is limit gauging of a screw thread?
9. What are touch trigger probes?
10. Write any two applications of ball bar tests?

Part – B (5 x 13 = 65 marks)

11. a) A new measuring system was being tested for an application. The quality control engineer performed a series of measurement studies on a shaft manufactured using a lathe. The diameter values of the standard shaft which was being tested were found to be: 50.1 mm, 50.2 mm, 50.1 mm, 50.2 mm, 50.0 mm and 50.1 mm respectively during repeated measurements. Assume the resolution of the

instrument is 0.1 mm. Report the results of the measurement with standard uncertainty considering Type A and Type B uncertainty sources. If the same measurements had been carried out using a micrometer based measurement system with 0.01 mm resolution and assuming the same results were obtained, report the measurement results considering the uncertainty sources under the changed scenario.

Or

b) A researcher used an internal micrometer (Resolution 0.01 mm) to measure the diameter of a hole drilled in a component. He used 6.00 mm drill. The values of the hole diameter during repeated measurements were – 6.20, 6.23, 6.22, 6.29, 6.20 mm. Express the hole size at 95% confidence level. What is your inference about the hole size as compared to the drill diameter?

12 a) Explain the working principle of Autocollimator with a neat diagram.

OR

b) A measuring machine bed was tested for straightness using an autocollimator and reflector. The heights of the various points (corresponding to various positions of the reflector along the bed) from a line parallel to the optical axis of the autocollimator are A – 4 μm, B – 6 μm, C - 3μm, D – 2 μm, E – 5 μm. If the distance between the support feet of the reflector is 100 mm, find the maximum deviation from a line through the end points.

13. a) Draw the GD&T symbol for any one form, orientation, and location parameter and write a short note on each of the parameter along with neat pictures to graphically explain the parameter?

OR

b) With respect to surface roughness measurement, write a note on Ra, Rq, Rt with a neat diagram. Arrange the parameters in decreasing order and give reasons for the same.

14. a) Derive the expression for measurement of tooth thickness of a gear tooth using gear tooth vernier caliper.

OR

b) Draw the profile of a metric thread and write a note on any four important parameters which have to be measured during a screw thread manufacturing process.

15. a) (i) Write a note about any one sensor used in Coordinate Measuring Machines. (7)
(ii) Write any four advantages of CMMs. (6)

OR

b) What is interferometry? Explain the working principle of interferometers for testing the straightness of machine tool guideways.

Part – C (1 x 15 = 15 marks)

16. Design the "general" type "GO" and "NO GO" gauges for a 25 H7/f8 fit. Use gauge tolerance of 10% of the work tolerance and wear allowance as 10% of the gauge tolerance. Show the work and gauge tolerance zones graphically. Report your answers as limiting values from the basic dimension. The upper deviation for f shaft = $-5.5\ D^{0.41}$. IT 7 = 16i; IT 8 = 25i. 25 mm lies in the diameter step of 18 and 30 mm.