Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51345

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024

Fifth/Sixth Semester

Mechanical Engineering

ME 3592 – METROLOGY AND MEASUREMENTS

(Common to : Industrial Engineering / Industrial Engineering and Management / Mechanical and Automation Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State any three factors affecting the measurements.
2. Briefly enumerate the calibration of measuring instruments.
3. Write the various types of linear measuring instruments.
4. Write any four precautions to be followed when using slip gauges.
5. What is interchangeability?
6. Define tolerances stack-up.
7. Distinguish Conventional and Geometric Tolerance.
8. What are the factors affecting surfaced roughness?
9. How to calibrate the interferometer?
10. Mention the applications of Machine vision system.

PART B — (5 × 13 = 65 marks)

11. (a) Explain in detail the classification of various measuring methods.

Or

(b) Elucidate the various systematic and random errors in measurements.

12. (a) With neat sketch explain the working principle of micro optic auto collimator.

Or

(b) Explain the following with neat sketch

(i) Sine bar (7)

(ii) Bevel Protractor (6)

13. (a) Explain in detail interchangeable manufacture and interchangeable Assembly with example for each.

Or

(b) A shaft is manufactured within the specified limits of 30.02 mm and 29.98 mm. Find the high and low limits of the bush to give a maximum clearance of 0.10 mm and minimum clearance of 0.02 mm.

14. (a) Enlist and explain in detail the different methods used for measuring the roundness with suitable example.

Or

(b) Explain the following with neat sketch

(i) Optical measurement techniques (7)

(ii) 3D Surface Metrology (6)

15. (a) Explain the working principle of AC LASER interferometer and how the straightness is measured?

Or

(b) With neat sketch explain the various types of CMM based on its construction. Also write the advantages of computer aided inspection.

PART C — (1 × 15 = 15 marks)

16. (a) Design a general type of GO and NO-GO gauge for components having 50 H7/d9 fit. The fundamental tolerance is calculated by the following Equation: i = 0.453 D3 + 0.001 D. The following data is given:(i) Upper deviation of shaft = –16D0.44 (ii) 50 mm falls in the diameter step of 30–50 mm (iii) IT7 = 16i (iv) IT9 = 40i (v) Wear allowance = 10% of gauge tolerance.

Or

(b) An electronic caliper was used to measure the length of an object. Five measurements were made. The results of the five measurements are: 21.53 mm, 21.51 mm, 20.52 mm, 21.48 mm and 21.42 mm. The workshop temperature during measurement was 21 °C. The calibration certificate of the electronic caliper says that the device will read within ±0.02 mm of the correct answer if it is used correctly and when the temperature is within 0 to 40 °C. Estimate the expanded uncertainty at a coverage factor of 2 providing coverage probability of approximately 95%.