Question Paper Code : X 60851

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020

Fifth/Seventh Semester

Mechanical Engineering

ME 2304/ME 1304/10122 ME 505/080120044/ME 54 – ENGINEERING METROLOGY AND MEASUREMENTS

(Common to Production Engineering)

(Regulations 2008/2010)

(Also Common to PTME2304 for B.E(Part-Time) Fourth Semester-Mechanical Engineering-Regulations 2009)

Time : Three Hours   Answer ALL questions.   Maximum : 100 Marks

PART – A   **(10×2=20 Marks)**

1. What do you mean by sensitivity of a measuring instrument ?

2. Define Readability.

3. Narrate the need for comparators..

4. Differentiate between sine bar and sine center.

5. What is the difference between R_z and R_t ?

6. What are thread gauges ?

7. Define machine vision.

8. Define Straightness of axes.

9. Give the principle of hot wire anemometer.

10. What is a Kentometer ?

PART – B   **(5×16=80 Marks)**

11. a) What are the good practices in measurement that need to be undertaken to get eliminated by such practices good measurement results ? Give any four examples of errors which can be eliminated by such practices.

(OR)

   b) i) What are the differences between repeatability and reproducibility conditions of measurement ?   **(6)**

   ii) Write short notes on interchangeable system of manufacturing.   **(10)**

12. a) With a neat sketch explain the working principle of pneumatic comparator.

$$\text{(OR)}$$

 b) i) What is sine bar ? How is it used for angle measurement ? **(8)**

  ii) Explain how sine bar is used to measure angle of a component. **(8)**

13. a) Explain how gear tooth thickness and base tangent length is measured using vernier gear tooth caliper and flange micrometer.

$$\text{(OR)}$$

 b) Explain the working principles of Gleason gear testing machine with neat sketch. Also list out its applications.

14. a) Explain the construction and working of a laser Telemetric system with a neat sketch.

$$\text{(OR)}$$

 b) Explain the construction and working of various bridge type Co-ordinate Measuring Machines.

15. a) i) With a sketch explain the torque measurement using Strain Gauges. **(8)**

  ii) Describe the construction of a hydraulic dynamometer and explain how it is used for power measurement. **(8)**

$$\text{(OR)}$$

 b) i) With a neat sketch explain the velocity measurement using Hot wire Anemometer. **(8)**

  ii) With a neat sketch explain the flow measurement using Pitot Tube. **(8)**

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Reg. No. :

Question Paper Code : X20844

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
AND APRIL/MAY 2021

Fourth/Fifth Semester

Mechanical Engineering

ME 6504 – METROLOGY AND MEASUREMENTS

(Common to Material Science and Engineering, Mechatronics Engineering)

(Regulations 2013)

(Also Common to PTME 6504 – Metrology and Measurement for B.E. (Part-Time)
Fourth Semester – Mechanical Engineering Regulations – 2014)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A   (10×2=20 Marks)

1. What is the difference between repeatability and reproducibility ?

2. What is the difference between allowance and tolerance ?

3. List out any four angular measuring instruments used in metrology.

4. What are the advantages of pneumatic comparator ?

5. What is meant by "Qualifying the tip" in CMMs ?

6. Write any four applications of artificial vision systems in manufacturing industries.

7. Define drunken thread.

8. What are the various factors affecting surface roughness of a machined component ?

9. Write the working principle of hot wire Anemometer.

10. What is the working principle of thermocouple ?

PART – B   **(5×13=65 Marks)**

11. a) Explain the various errors in measurements.   **(13)**

    (OR)

    b) What is the need of calibration ? Explain the classification of various
    standards.   **(13)**

12. a) i) With a neat diagram explain the working of angle dekkor.   **(10)**

    ii) Why are sine bars not used for measuring large angles ?   **(3)**

    (OR)

    b) Explain the construction, working principle and applications of Sine Bar.

13. a) Explain different types of CMM, in detail.   **(13)**

    (OR)

    b) Explain the working principle of a AC laser interferometer with a neat
    diagram.   **(13)**

14. a) Describe the construction of gear tooth vernier caliper. Explain how it can
    be used for measuring the tooth thickness.   **(13)**

    (OR)

    b) Enlist and explain the different methods used for measuring the roundness. **(13)**

15. a) Discuss about any two types of measurement of temperature.   **(13)**

    (OR)

    b) Explain the working of rotameter and orificemeter with neat sketches. **(13)**

PART – C   **(1×15=15 Marks)**

16. a) Calculate the tolerances, fundamental deviations and limits of sizes for
    the shaft designated as 40 H 8/f7. Standard tolerance for IT 7 is 16i and
    IT 8 is 25i. Where 'i' is the standard tolerance unit. Upper deviation for
    'f' shaft is -5.5$D^{0.41}$, 40 mm lies in the diameter range 30-50mm.

    (OR)

    b) Design general type GO and NO GO gauges for a 40H7/d8 fit. 40 mm lies
    in the diameter range 30 to 50. Show graphically the disposition of gauge
    tolerance zones relative to the work tolerance zones. Standard tolerance for
    IT7 is 16i and IT8 is 25i, where 'I' is the standard tolerance unit. The upper

    deviation for 'd' shaft is -16$D^{0.44}$

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 40831

B.E./B.Tech DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Mechanical Engineering

ME 8501 – METROLOGY AND MEASUREMENTS

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How does 'person' as a factor influence the results of a measurement?

2. Discuss the basis of selecting a standard for a particular type of measurement?

3. Write short notes on 'Ring guages'.

4. What is selective assembly?

5. What is the advantage of using polarized beam splitter over ordinary glass based beam splitter?

6. Mention about the uses of various types of probes used in CMMs.

7. List out the difficulties witnessed in the measurement of flatness of a surface.

8. Brief on the effect of stylus and skid in measurement of surface roughness.

9. What are the uses of a force transducer?

10. Define 'Reliability'.

PART B — (5 × 13 = 65 marks)

11. (a)   Briefly explain the elements of a measurement system.   (13)

Or

    (b)   Explain various types of errors that occur in engineering measurements.
                                                                          (13)

12. (a) Explain the concept of interchangeability applied to industries. (13)

Or

(b) Explain various cases of application of sine bars with neat diagrams. (13)

13. (a) Explain with case studies the use of laser interferometers for linear and angular measurements. (13)

Or

(b) Describe various Industrial applications of CMMs with sketches wherever needed. (13)

14. (a) Explain the procedure for finding the chordal thickness of a gear using a gear tooth vernier caliper. (13)

Or

(b) Describe various comparison methods of surface assessment. (13)

15. (a) Explain any two types of flow meters with neat diagrams stating their advantages and disadvantages. (13)

Or

(b) With a neat sketch explain the working of electrical resistance thermometer. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Elaborate on the importance of roughness and waviness in context to various engineering applications. (15)

Or

(b) Explain the scope of machine vision in a blotting plant with suitable sketches. (15)

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 90860

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022

Fifth Semester

Mechanical Engineering

ME 8501 – METROLOGY AND MEASUREMENTS

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between precision and accuracy.

2. Compare between Line and End standards with example.

3. State "Taylor's principle of gauge design".

4. A vernier scale consists of 25 divisions on 12 mm spacing and the main scale has 24 divisions on 12 mm. What is the least count?

5. Why is laser preferred in engineering metrology?

6. List any four possible causes of errors in CMM.

7. Figuratively represent the different elements of external screw thread.

8. Assume that the surface roughness profile is triangular as shown in fig. If the peak to valley height is $20\,\mu m$. Calculate the Centre Line Average (CLA) surface roughness Ra (in μm), if the datum line is at the middle of the triangles

Fig. Surface Roughness Profile

9. Why measuring instruments are calibrated?

10. Give the applications of bimetallic strips.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Give the structure of generalized measurement system with neat sketch (5)

    (ii) Describe briefly about the following:

        (1) Range of measurement (2)

        (2) Repeatability (2)

        (3) Traceability (2)

        (4) Calibration (2)

Or

   (b) A person weighs around 75 kg. He checks his weight using three different instruments. Following were the results obtained from the instruments:

Instrument 1	Instrument 2	Instrument 3
74	69	80
78	68	85
80	67	84
70	66	90
72	68	89
77	66	86

What types of errors are associated with these instruments and how it affects its accuracy and precision?

12. (a) (i) Explain the construction of Vernier Height Gauge with neat sketch (10)

    (ii) List the applications of Vernier Height Gauge. (3)

Or

   (b) (i) Write short note on interchangeability with an example. (3)

    (ii) Describe with a sketch the principle behind the working of an autocollimator and mention its types. (10)

13. (a) Describe the working principle of a dual frequency AC laser interferometer with neat sketch.

Or

   (b) Explain with a neat sketch the various stages of Machine Vision System and its application in metrology.

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14. (a) Discuss the working principle of Parkinson gear tester with a neat sketch and its usage to check the composite errors in spur gear.

Or

(b) Discuss the working principle of Tomlinson Surface Meter for surface measurement with a neat sketch.

15. (a) (i) Enumerate the various devices to measure temperature. (3)

(ii) Explain the construction and working principle of thermocouple with neat sketch. (7)

(iii) Mention any two advantages and disadvantages of thermocouple. (3)

Or

(b) (i) Describe with neat sketch, the construction and working principle of the pitot tube. (8)

(ii) Describe the working principle of hydraulic dynamometer for measuring shaft power. (5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Write the significance of torque measurement. (5)

(ii) With neat sketch explain any two types of torque measurement techniques. (10)

Or

(b) List the various configurations of coordinate measuring machine. Explain the constructional features of any three configurations of CMM. Point out the applications of CMM in machine tool metrology.

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 90860

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022

Fifth Semester

Mechanical Engineering

ME 8501 – METROLOGY AND MEASUREMENTS

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between precision and accuracy.

2. Compare between Line and End standards with example.

3. State "Taylor's principle of gauge design".

4. A vernier scale consists of 25 divisions on 12 mm spacing and the main scale has 24 divisions on 12 mm. What is the least count?

5. Why is laser preferred in engineering metrology?

6. List any four possible causes of errors in CMM.

7. Figuratively represent the different elements of external screw thread.

8. Assume that the surface roughness profile is triangular as shown in fig. If the peak to valley height is $20\,\mu m$. Calculate the Centre Line Average (CLA) surface roughness Ra (in μm), if the datum line is at the middle of the triangles

Fig. Surface Roughness Profile

9. Why measuring instruments are calibrated?

10. Give the applications of bimetallic strips.

11. (a) (i) Give the structure of generalized measurement system with neat sketch (5)

(ii) Describe briefly about the following:

(1) Range of measurement (2)

(2) Repeatability (2)

(3) Traceability (2)

(4) Calibration (2)

Or

(b) A person weighs around 75 kg. He checks his weight using three different instruments. Following were the results obtained from the instruments:

Instrument 1	Instrument 2	Instrument 3
74	69	80
78	68	85
80	67	84
70	66	90
72	68	89
77	66	86

What types of errors are associated with these instruments and how it affects its accuracy and precision?

12. (a) (i) Explain the construction of Vernier Height Gauge with neat sketch (10)

(ii) List the applications of Vernier Height Gauge. (3)

Or

(b) (i) Write short note on interchangeability with an example. (3)

(ii) Describe with a sketch the principle behind the working of an autocollimator and mention its types. (10)

13. (a) Describe the working principle of a dual frequency AC laser interferometer with neat sketch.

Or

(b) Explain with a neat sketch the various stages of Machine Vision System and its application in metrology.

14. (a) Discuss the working principle of Parkinson gear tester with a neat sketch and its usage to check the composite errors in spur gear.

Or

(b) Discuss the working principle of Tomlinson Surface Meter for surface measurement with a neat sketch.

15. (a) (i) Enumerate the various devices to measure temperature. (3)

(ii) Explain the construction and working principle of thermocouple with neat sketch. (7)

(iii) Mention any two advantages and disadvantages of thermocouple. (3)

Or

(b) (i) Describe with neat sketch, the construction and working principle of the pitot tube. (8)

(ii) Describe the working principle of hydraulic dynamometer for measuring shaft power. (5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Write the significance of torque measurement. (5)

(ii) With neat sketch explain any two types of torque measurement techniques. (10)

Or

(b) List the various configurations of coordinate measuring machine. Explain the constructional features of any three configurations of CMM. Point out the applications of CMM in machine tool metrology.

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Reg. No. :

Question Paper Code : 50877

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Mechanical Engineering

ME 8501 – METROLOGY AND MEASUREMENTS

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between precision and accuracy.

2. List any four methods of measurement.

3. List out any four angular measuring instruments used in metrology.

4. Define clinometers.

5. Differentiate straightness and flatness of the surface plate.

6. List any four possible causes of errors in CMM.

7. Point out any four methods of measuring roundness of hollow shaft.

8. State the drunken error in screw threads.

9. Distinguish between force and torque.

10. Give the applications of a bimetallic strips

PART B — (5 × 13 = 65 marks)

11. (a) Explain the classification of various measuring methods and its merits.

Or

(b) Explain in details with a suitable examples of

(i) Repeatability (1.5)

(ii) Reproducibility (1.5)

(iii) Systematic and random error (5)

(iv) Static and dynamic Response. (5)

12. (a) Explain the working principle of an autocollimator with a neat sketch and its application.

Or

(b) Explain in detail with a neat sketch of any two bevel protractors.

13. (a) With a neat sketch describe the working of AC laser interferometer.

Or

(b) Explain the various steps of machine vision system in metrology and its advantages and disadvantages.

14. (a) Explain in detail with a neat sketch of gear tooth Vernier method of measuring the involute gear tooth thickness.

Or

(b) Explain how to measure the specifications of the buttress screw thread by using the tool makers microscope.

15. (a) Explain the working principle of an electrical resistance thermometer.

Or

(b) With neat sketch explain the working principle of ultrasonic flow meter.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the needs, types and constructional features of coordinated measuring machine used in Aerospace industry.

Or

(b) How laser is used in measurement in welding applications? Explain the basic principle involved in anyone applications.

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Reg. No. : [   ]

Question Paper Code : 21302

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Mechanical Engineering

ME 3592 – METROLOGY AND MEASUREMENTS

(Common to : Industrial Engineering and Industrial Engineering and Management)

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Summarize various elements of measurement.

2. Mention the main objectives of traceability.

3. List some of the parameters measured by Angle gauges.

4. Discuss the working principle of an autocollimator.

5. Define tolerance and mention its classification.

6. Draw the relationship between fundamental, upper and lower deviations in limits and fits.

7. What is the purpose of angle dekkor?

8. Explain the radial runout and axial runout.

9. Discuss the major applications of CMM.

10. Outline the elements of flexible inspection system.

PART B — (5 × 13 = 65 marks)

11. (a) Elaborate two broad categories of errors in measurement with suitable example.

                                  Or

    (b) Explain the working principle of a pneumatic back pressure gauge. Discuss the relevance of the characteristic curve in measurement.

12. (a) Discuss the procedure to measure the unknown angles with Sine Bar. Also, mention the use of Sine Blocks. Sine Plates, and Sine Tables.

Or

(b) Outline the constructional details of gear tooth caliper to measure the tooth thickness.

13. (a) A clearance fit has to be provided for a shaft and bearing assembly having a diameter of 40 mm. Tolerances on hole and shaft are 0.006 and 0.004 mm, respectively. The tolerances are disposed unilaterally. If an allowance of 0.002 mm is provided, find the limits of size for hole and shaft when (i) hole basis system and (ii) shaft basis system are used.

Or

(b) Summarize the various methods of tolerance specification on inspection Gauges with diagrams of disposition.

14. (a) Explain the working principle of stylus type surface roughness tester with a neat sketch.

Or

(b) Discuss various acceptance tests to be conducted for milling machine with required illustration.

15. (a) Elaborate the construction and working principle of Laser Interferometer used in metrology.

Or

(b) Analyze the five popular physical configurations used in machine vision system.

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 :

$i = 0.453\sqrt[3]{D} + 0.001D$

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) Enunciate the various stages involved in machine vision system with an example.

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Reg. No. : ⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜

Question Paper Code : 70899

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Mechanical Engineering

ME 8501 – METROLOGY AND MEASUREMENTS

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How is the standard associated with measuring a work piece decided?

2. Distinguish between line standards and end standards.

3. State Taylor's principle of gauge design.

4. Which angle measuring device is best suitable for probing the V-block?

5. What are the metrological uses of lasers?

6. Suggest a case where machine vision system can be used for identifying the outsiders.

7. Define minor diameter of a screw thread.

8. Write about the type of error that is expected in turning a particular type of steel component that is found to possess varying hardness.

9. What are the advantages of mechanical force measuring devices?

10. The reliability of Components A, B and C connected in series are 0.95, 0.90 and 0.65 respectively. The reliability of the system needs to be improved. What would your suggestion to achieve the same?

PART B — (5 × 13 = 65 marks)

11. (a) Explain how various factors influence the measurement with supporting examples.

Or

(b) (i) Distinguish between 'precision' and 'accuracy'. (6)

(ii) Write detailed notes on the control measures you will take in order to eliminate measurement errors in a metrology laboratory. (7)

12. (a) Explain the concept of interchangeability and Selective assembly applied to a manufacturing company that manufactures shafts.

Or

(b) (i) Explain how a sine bar is used for measuring angles of components. (6)

(ii) Compare and contrast an autocollimator with an alignment telescope. (7)

13. (a) (i) Compare and contrast an AC and DC laser interferometer. (6)

(ii) Suggest a CMM that is best suitable for offline inspection of assemblies and justify your answer. (7)

Or

(b) Explain the constructional details and limitations of probes used in CMMs.

14. (a) Describe the method of checking the straightness of a component with diagrams wherever needed.

Or

(b) Explain the construction and working of a Tomlinson's surface meter.

15. (a) Explain the design and functioning of a flow measurement device of your choice with the aid of a labelled diagram.

Or

(b) Explain the construction, working and limitations of resistance thermometer.

PART C — (1 × 15 = 15 marks)

16. (a) An automobile spare parts manufacturing company has a metrology lab which is concerned with linear and angular measurements. List 10 possible chances of errors that may arise in engineering measurement in such a lab and the ways of fixing them.

Or

(b) What are the possible chances of employing machine vision in a food processing company that manufactures a wide variety of food items and beverages? Also discuss the ways machine vision system could be used at different stages of food processing.

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 80914

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

Fifth Semester

Mechanical Engineering

ME 8501 — METROLOGY AND MEASUREMENTS

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between accuracy and precision.

2. Mention the sources of error and its remedial measures.

3. Mention at least four applications of a limit gauges.

4. Define the concept of interchangeability with suitable example.

5. What are the elements of machine vision system?

6. State the advantages of laser used in interferometers.

7. Distinguish between dedendum and a base circle in a spur gear tooth profile.

8. Figuratively represent the different elements of external screw threads.

9. Give the applications of bimetallic strips.

10. Discuss briefly about the problem faced in measuring temperature of a flowing fluid.

PART B — (5 × 13 = 65 marks)

11. (a) Illustrate the various factors affecting the accuracy of the measuring system with an appropriate industrial application.

Or

(b) (i) Discuss the structure of generalized measurement system in detail with neat sketch. (10)

(ii) Differentiate between systematic and random errors. (3)

12. (a) (i) Write short note on Tailor's principle of gauge design. (5)

(ii) Discuss in detail about the method of tolerance specification of gauges. (8)

Or

(b) Describe how an autocollimator works, and provide an overview of its main types. Explain the practical applications and advantages of each type. Provide labeled diagrams and relevant equations where applicable to support your explanation.

13. (a) List the various configurations of coordinate measuring machine. Explain the constructional features of any two configuration that are frequently used.

Or

(b) Describe the working principle of a dual frequency AC laser interferometer with neat sketch.

14. (a) (i) List the various types of screw threads and also sketch the details of British Standard Whitworth (BSW) thread. (5)

(ii) Describe the measurement of effective diameter of a screw thread by two wire method using floating carriage micrometer. (8)

Or

(b) Discuss the working principle of Parkinson gear tester with a neat sketch and its usage to check the composite errors in spur gear.

15. (a) Demonstrate the application of any one type of force measurement device used in force measurement with appropriate definitions, principles and working methodology.

Or

(b) (i) Describe with neat sketch, the construction and working principle of the pitot tube. (8)

(ii) Discuss in detail about the need of calibration and reliability of temperature measuring instruments. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Tailstock of the lathe is manufactured in the production shop. Discuss the various steps of inspection and list the measuring instruments required.

Or

(b) List the devices used to measure flow rate. Compare the merits and demerits of all listed flow measuring devices. Suggest a suitable device along with valid reasons, to measure the flow rate of conductive fluid? If given an opportunity, design a device of your idea, and compare it with a device suggested earlier.

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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

51345

(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%.

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