| Reg. No. | | | | | | | | | | | | | | | |
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| Question Paper Code | 13536 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025**

Fourth Semester

**Mechanical Engineering**

**20MEPC402 – METROLOGY, MEASUREMENTS AND COMPUTER AIDED INSPECTION**

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

| | | *Marks* | *K – Level* | *CO* |
|---|---|---|---|---|
| 1. | While taking a measurement with the help of a Micrometer, which two parts of a Micrometer are used to hold the specimen?<br>(a) Spindle and Anvil (b) Spindle and Ratchet<br>(c) Anvil and Ratchet (d) Anvil and Barrel | *1* | *K1* | *CO1* |
| 2. | The ease with which observations can be made accurately is referred to as<br>(a) readability (b) sensitivity (c) accuracy (d) precision | *1* | *K1* | *CO1* |
| 3. | The working principle of sine bar is<br>(a) trigonometry (b) optimetry (c) interferometry (d) algebraic | *1* | *K1* | *CO2* |
| 4. | Which one of the following contributes most to achieving interchangeability?<br>(a) Use of non-standard materials<br>(b) Variable manufacturing processes<br>(c) Standardization of components and tolerances<br>(d) Manual adjustments during assembly | *1* | *K1* | *CO2* |
| 5. | Thermocouple works based on<br>(a) Peltier Effect (b) Kelvin Effect (c) Thomson Effect (d) Seebeck Effect | *1* | *K1* | *CO3* |
| 6. | Which of the following devices works on the principle of mutual inductance?<br>(a) Potentiometer (b) Rheostat (c) Piezoelectric Crystal (d) LVDT | *1* | *K1* | *CO3* |
| 7. | What precise movement does CMM have?<br>(a) Precise movement in x coordinate<br>(b) Precise movement in x and y coordinates<br>(c) Precise movement in y and z coordinates<br>(d) Precise movement in x, y and z coordinates | *1* | *K1* | *CO4* |
| 8. | Which of the following is a contact type of automated inspection method?<br>(a) Inspection probe (b) Laser scanning<br>(c) Electric field (d) All the above mentioned | *1* | *K1* | *CO4* |
| 9. | Which of the following option is incorrect for flatness testing by interferometry?<br>(a) For checking concave or convex surface optical flat is pressed lightly<br>(b) If angle between optical flat and work surface reduces, then fringe spacing decreases<br>(c) For perfectly flat surface condition of complete interference satisfies<br>(d) Only one point contact between optical flat and surface is possible in some cases | *1* | *K1* | *CO5* |
| 10. | What is another name of computer aided inspection?<br>(a) Computer Aided Machining (b) Computer Aided Drafting<br>(c) Machine Vision (d) Visionary Inspection | *1* | *K1* | *CO6* |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

| | | | | |
|---|---|---|---|---|
| 11. | List down the various types of linear measuring instruments. | *2* | *K1* | *CO1* |
| 12. | During the quality inspection of a component, the quality control inspector measures the dimension of the component using a vernier caliper. The main scale reading is 25 mm and the vernier scale coincidence is 22. The L.C is 0.02mm. Calculate the actual dimension of the component. | *2* | *K2* | *CO1* |

| | | | | | |
|---|---|---|---|---|---|
| 13. | What is the purpose of using a clinometer? | 2 | K1 | CO2 |
| 14. | A sine bar was used to measure the taper angle of the specimen and the gauge block was 5.055 mm. What is the taper angle? | 2 | K2 | CO2 |
| 15. | "A regular vernier caliper cannot be used to measure the thickness of gear teeth" - Justify | 2 | K2 | CO3 |
| 16. | Pen down the function of a transducer. | 2 | K1 | CO3 |
| 17. | Why is calibration important in a CMM? | 2 | K2 | CO4 |
| 18. | Brief down the application of CMM in the inspection of automotive components. | 2 | K2 | CO4 |
| 19. | What is meant by interferometry, and how it is used in metrology? | 2 | K1 | CO5 |
| 20. | State the role of the laser source in the NPL Flatness Interferometer? | 2 | K1 | CO5 |
| 21. | What is the role of image processing in Computer Aided Inspection? | 2 | K1 | CO6 |
| 22. | Why is uniform lighting important during the image acquisition in a machine vision system? | 2 | K2 | CO6 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

| | | | | | |
|---|---|---|---|---|---|
| 23. | a) | In the quality control division of an organization, the diameter of a component has to be verified using a micrometer. Discuss the procedure for the same. Provide suitable diagram. | 11 | K2 | CO1 |
| | | **OR** | | | |
| | b) | Discuss the different types of error in measurement and sources for the same in detail. | 11 | K2 | CO1 |
| 24. | a) | With a neat sketch describe the working principle of Auto collimator. | 11 | K3 | CO2 |
| | | **OR** | | | |
| | b) | Describe the working principle of a stylus-type surface roughness tester. Discuss its construction, operation, and limitations. | 11 | K3 | CO2 |
| 25. | a) | Explain the sources of error in gear tooth measurement using a vernier caliper and how they can be minimized. | 11 | K2 | CO3 |
| | | **OR** | | | |
| | b) | With suitable justification, explain how bimetallic strips are used in thermostats for heating and cooling applications. | 11 | K2 | CO3 |
| 26. | a) | Describe the basic components of a CMM system. | 11 | K2 | CO4 |
| | | **OR** | | | |
| | b) | Explain the working principle of probes used in coordinate measuring machines. Illustrate with diagrams. | 11 | K2 | CO4 |
| 27. | a) | Explain the principle of interferometry. How does interference help in precision measurement? | 11 | K2 | CO5 |
| | | **OR** | | | |
| | b) | Explain the working principle of the NPL flatness interferometer. How does it differ from conventional interferometers? | 11 | K2 | CO5 |
| 28. | a) | Describe the steps involved in a typical machine vision inspection process. | 11 | K3 | CO6 |
| | | **OR** | | | |
| | b) | Discuss the role of machine vision in monitoring conveyor belts and detecting blockages or unsafe material flow. | 11 | K3 | CO6 |