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Question Paper Code	13412
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B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Eighth Semester

Mechanical and Automation Engineering

20MUPE809 - 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. What is the primary purpose of metrology in engineering? (a) Data storage (b) Measurement and verification (c) Estimation of costs (d) None of the above	1	K1	CO1
2. Laser scanners are commonly used for: (a) Checking raw materials (b) Capturing 3D geometry of an object (c) Drilling holes (d) Storing data	1	K1	CO1
3. In precision metrology, which factor contributes most to measurement uncertainty? (a) Manufacturing cost (b) Random and systematic errors (c) Operator skill (d) Measurement time	1	K1	CO2
4. Error mapping is used to: (a) Predict and correct systematic errors (b) Increase structural compliance (c) Reduce thermal effects (d) Improve operator skills	1	K1	CO2
5. What is the purpose of applying filters to CMM data? (a) To remove noise and outliers (b) To increase measurement speed (c) To reduce the number of data points (d) To improve machine calibration	1	K1	CO3
6. What is the recommended temperature for operating a CMM in a controlled environment? (a) 10°C (b) 20°C (c) 30°C (d) 40°C	1	K1	CO3
7. Which of the following is a characteristic of a Gaussian filter? (a) It allows only high-frequency components to pass (b) It is a type of optical filter (c) It smooths data by reducing high-frequency noise (d) It amplifies surface roughness	1	K1	CO4
8. Which surface measurement technique uses laser interferometry? (a) Scanning Electron Microscopy (SEM) (b) Optical Interferometry (c) Stylus Profilometry (d) Atomic Force Microscopy (AFM)	1	K1	CO4
9. Which of the following is a key challenge in nanometrology? (a) High cost of equipment (b) Difficulty in measuring small features (c) Lack of standardization (d) All of the above	1	K1	CO5
10. Which of the following is a non-optical method for nanoscale measurement? (a) Scanning Probe Microscopy (SPM) (b) White-light interferometry (c) Fringe projection (d) Focus-based metrology	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. List down the primary difference between basic and advanced metrology.	2	K1	CO1
12. State the principle of the fringe projection method.	2	K1	CO1
13. List two advantages of machine vision in dimensional metrology.	2	K1	CO1
14. Does thermal effects influence spindle performance?	2	K2	CO2
15. Infer the purpose of an error budget in precision engineering.	2	K2	CO2
16. Show the main sources of thermal errors in machine tools.	2	K1	CO2

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| 17. Summarize the purpose of using filters in CMM? | 2 | K2 | CO3 |
| 18. Infer the necessity of calibration for CMM. | 2 | K2 | CO3 |
| 19. How does surface roughness impact the manufacturing process? | 2 | K1 | CO4 |
| 20. Define Bearing Area Curve (BAC), and why is it important. | 2 | K1 | CO4 |
| 21. What is focus-based optical metrology? | 2 | K1 | CO5 |
| 22. Write down the significance of traceability in nanometrology. | 2 | K1 | CO5 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) | With neat sketch explain the working mechanism of a laser tracking system. | 11 | K2 | CO1 |
| OR | | | | |
| b) | Explain the working principle and steps involved in machine vision system. | 11 | K2 | CO1 |
| 24. a) | Enumerate the different types of measurement errors and their impact on precision machining. | 11 | K3 | CO2 |
| OR | | | | |
| b) | Infer the terms error mapping, error budget, error compensation in Computer measuring system. | 11 | K3 | CO2 |
| 25. a) | Summarize the functions of filters in CMS, and explain various types of filters used. | 11 | K2 | CO3 |
| OR | | | | |
| b) | Explain Coordinate Measuring System with its components and working steps involved. | 11 | K2 | CO3 |
| 26. a) | Outline the construction and working principles of scanning electron microscopes (SEM). | 11 | K2 | CO4 |
| OR | | | | |
| b) | With neat sketch explain the construction and working principles of scanning probe microscopes (SPM). | 11 | K2 | CO4 |
| 27. a) | Describe the working principle of Laser-based optical metrology technique with neat sketch. | 11 | K2 | CO5 |
| OR | | | | |
| b) | Outline the working principle of Transmission Electron Microscope (TEM) with neat sketch. | 11 | K2 | CO5 |
| 28. a) (i) | Explain the applications and advantages of chromatic confocal microscopy. | 6 | K2 | CO4 |
| (ii) | Describe the working principle of Laser-based optical metrology technique. | 5 | K2 | CO5 |
| OR | | | | |
| b) (i) | Infer the importance of surface geometry in functional performance and manufacturing. | 6 | K2 | CO4 |
| (ii) | Discuss the applications, advantages and limitations of white-light interference microscopy. | 5 | K2 | CO5 |