

- Engineering Metrology and Measurements

TWO MARK QUESTION AND ANSWERS - UNIT 4

1. What is interferometer?

Interferometer is optical instruments used for measuring flatness and determining the lengths of slip gauges by direct reference to the wavelength of light.

2. Name the different types of interferometer?

1) NPL flatness interferometer 2) Michelson interferometer 3) Laser interferometer 4) Zygo gauge block interferometer.

3. What is crest and trough?

The light is a form of energy being propagated by electromagnetic waves, which is a sine curve. The high point of the wave is called crest and the low point is called trough.

4. What is wavelength?

The distance between two crests or two troughs is called the wavelength.

5. What is meant by alignment test on machine tools?

The alignment test is carried out to check the grade of manufacturing accuracy of the machine tool.

6. List the various geometrical checks made on machine tools.

a. Straightness of guide ways and slide ways of machine tool. b. Flatness of machine tables and slide ways. c. Parallelism, equidistance and alignment of the slide ways. d. True running and alignment of shaft and spindle. e. The pitch error or lead of lead screw. f. Pitch errors of gears.

7. Distinguish between geometrical test and practical test on a machine tool

The alignment test is carried out to check the grade of manufacturing accuracy of the machine tool. Performance test consists of checking the accuracy of the finished component. Alignment test consists of checking the relationship between various machine elements when

the machine tool is idle. Performance test consists of preparing the actual test jobs on the machine and checking the accuracy of the jobs produced. .

8. What are the main spindle errors?

a) Out of round. b) Eccentricity c) Radial throw of an axis. d) Run out e) Periodical axial slip .

9. Write the various tests conducted on any machine tools

1) Test for level of installation of machine tool in horizontal and vertical planes. 2. Test for flatness of machine bed and for straightness and parallelism of bed ways on bearing surface.

10. Test for perpendicularity of guide ways to other guide ways.

Test for true running of the main spindle and its axial movements.

11. Why the laser is used in alignment testing?

The alignment tests can be carried out over greater distances and to a greater degree of accuracy using laser equipment. Laser equipment produces real straight line, whereas an alignment telescope provides a, imaginary line that cannot be seen in space.

12. Classify the machine tool test.

It can be classified into 1. Static tests 2. Dynamic tests. What are the different types of geometrical tests conducted on machine tools? 1. Straightness. , 2. Flatness. , 3. Parallelism, equi-distance and coincidence.

13. What is the principle of laser.

The photon emitted during stimulated emission has the same energy, phase and frequency as the incident photon. This principle states that the photon comes in contact with another atom or molecule in the higher energy level E_2 then it will cause the atom to return to ground state energy level E_1 , by releasing another photon.

The sequence of triggered identical photon from stimulated at E_2 is known as stimulated emission. This multiplication of photon through stimulated emission' leads to

coherent, powerful, monochromatic, collimated beam of light emission. This light emission is called laser.

14. What is CMM?

It is a three dimensional measurements for various components. These machines have precise movement in x,y,z coordinates which can be easily controlled and measured. Each slide in three directions is equipped with a precision linear measurement transducer which gives digital display and senses positive and negative direction.

15. Define axial length measuring accuracy.

It is defined as difference between the reference length of gauges aligned with a machine axis and the corresponding measurement results from the machine.

16. Write the types of coordinate measuring machines.

o Bridge type o Horizontal bore mill o Vertical bore mill o Spherical coordinate measuring machine

17. Explain CNC, CMM briefly.

A computer numerical control system can be used with CMM to do calculations while measuring complex parts.

Error can be stored in memory while doing calculations. For automatic calibration of probe, determination of co-ordinate system, calculation, evaluation and recording etc., special software's are incorporated.

18. Write some features of CMM software.

Measurement of diameter, center distance can be measured as follows: 1. Measurement of plane and spatial curves 4. Digital input and output command 5. Interface to CAD software 6. Data communications.

19. Define machine vision.

Machine vision can be defined as a means of simulating the image recognition and analysis capabilities of the human system with electronic and electromechanical techniques. .

20. What are the four basic types of machine vision system?

(i) Image formation. (ii) Analyzing the image (iii) Processing of image. (iv) Interpretation of image. 21. Write the advantages of machine vision system (i) Reduction of tooling and fixture cost. (ii) Integrated automation of dimensional verification (iii) Elimination of need for precise part location. (iv) Defect detection.

23. Define greyscale analysis.

In these techniques, discrete areas or windows are formed around only the portions of the image to be inspected. For determining if brackets are present, high intensity lighting is positioned. This type of discrete area analysis is a powerful tool and can be used for inspection of absence, correct part assembly, orientation, part, integrity, etc.

24. Mention the advantages of CMM.

(i) The inspection rate is increased. (ii) Accuracy is reduced. (iii) Operator's error can be minimized. (iv) Skill of the operator is reduced. (v) Reduction in calculating, recording and set up time. (vi) No need of GO/NOGO gauges. (vii) Reduction of scrap and good part rejection.

25. Mention the disadvantages of CMM.

(i) The table and probe may not be in perfect alignment. (ii) The stylus may have run out. (iii) The stylus moving in z-axis may have some perpendicularity errors. (iv) Stylus while moving in x and y direction may not be square to each other. (v) There may be errors in digital system.

26. Mention the application of CMM.

(i) CMM's find application in automobile, machine tools, electronics, space and many other large companies. (ii) These are best suited for the test and inspection of test equipment, gauges and tools. (iii) For aircraft and space vehicles of hundred Percent inspections is carried out by using CMM. (iv) CMM can be used for determining dimensional accuracy of the component. (v) CMM can also be used for sorting tasks to achieve optimum packing of components within tolerance limits.

27. Describe the features of a flexible inspection system.

(i) A powerful computer serves as a real time processor to handle part dimensional data and as a multi 'programming system to perform such tasks as manufacturing p I rocess control. (ii) The terminal provides interactive communication with personnel Computer where the programmes are stored. (iii) Input devices microprocessor based gauges and other inspection.

28. Write brief note about

(i) Co-ordinate measuring machine equipped with a laser probe

(ii) Virtual measuring system

(i) A CMM equipped with a laser probe can convert a part of physical model into a digitize file. Such a file can be compared with other file and can be manipulated by designers to improve quality. Manufactures can verify that each finished part measures exactly as designed.

(ii) Virtual measuring System uses a microscope system to' examine an electronic replica of the Surface texture of part. Such a system is non-contact 3-1) Surface measurement system and provide image of the surface.

The images are processed on a PC using vertical scanning interferometry and vision analysis software to produce 2D-profile, 3-D plots and counter plots. It generates statistics for average roughness, average profile height, reduced peak height, cares roughness depth, reduced valley depth and a number of other parameters.

It also determines the depth, spacing and angle of groove in a hared surface optical probe of a cylinder bore can be rotated 360 degrees and moved vertically along the cylinder wall.

29. Explain briefly the three important fields of machine vision system Inspection:

It is the ability of an automated vision system to recognize well-defined pattern and if these pattern match these stored in the system makes machine vision ideal for inspect ion of raw materials, parts, assemblies etc. Part identification: It is the ability of part recognition provides positive identifications of an object for decision-making purposes. Guidance and Control. Machine vision systems are used to provide sensor feedback for real time guidance.

30. Define straightness of axes.

Perfect straightness of an axis occurs when all points of the axis lie on a straight line. Straightness is a form control. The straightness control (u) defines how much an axis of a real part may vary from an ideal straight line.

31. Write the application of laser interferometry.

It is used for the dimensional measurement of objects and object scanning for various shapes of objects.

32. What is CNC CMM.

Coordinate measuring machine (CMM) is a device for measuring the physical geometrical characteristics of an object. This machine may be manually controlled by an operator or it may be computer controlled. Measurements are defined by a probe attached to the third moving axis of this machine.

33. Why is monochromatic light used in interferometry.

Interferometers are widely used in science and industry for the measurement of small displacements, refractive index changes and surface irregularities. In analytical science, interferometers are used in continuous wave Fourier transform spectroscopy to analyze light containing features of absorption or emission associated with a substance or mixture.

34. What are the advantages of computer aided inspection.

- Improve customer satisfaction
- Maximize process efficiencies
- Increase competitive advantage and market share
- Save millions of dollars in operating expenses