SRINIVASAN ENGINEERING COLLEGE

DEPARTMENT OF AERONAUTICAL ENGINEERING

AE-2352 Experimental Stress Analysis

Two Mark Questions

Unit I

1. Define Measurement:

The measurement of a given quantity is essentially an act or result of comparison between a quantity whose magnitude (amount) is unknown, with a similar quantity whose magnitude (amount) is known, the later quantity being called a standard.

2. What are the basic requirements for measurement?

(i) The standard used for comparison purposes must be accurately defined & should be commonly acceptable.

(ii) The standard must be of the same character as the measure and (ie, the unknown quantity or the quantity under measurement)

(iii) The apparatus used and the method accepted for the purposes of comparison must be provable.

3. What are the methods of measurements?

(i) Direct Method: In these methods, MEASURAND is directly compared against a STANDARD.

(ii) Indirect Method: Measuring systems are used in indirect methods for measurement purposes

4. What is dimensional measurement?

Dimensional Measurements are characterized as determination of size of an object. These are the measurements of dimensions of an object.

5. What are the 'STANDARD'S for the measurement of an angle?

The primary standards of angle may be taken either as angle subtended by a circle at its centre ie, 360° or as angle between two straight line intersecting in a manner such that all four angles so formed are equal, ie, each angle is 90°

6. How we can measure the Area of survey plats?

Measurement of area of regular and standard geometrical figures can be obtained from the dimensions using standard mathematical relationships.

There are many engineering applications which require the measurement of plane area. Graphical determination of the area of survey plots form maps, the integration of function to determine the area enclosed by a curve analysis of experimental data may require the use of measurement of plane area.

7. Give any two methods for measure an unknown force

An unknown force may be measured by the following methods,

1. Balancing the unknown force against the known gravitational force either directly (or) indirectly using a system of levers.
2. Transferring the unknown force to a fluid pressure and then meaning the resulting fluid pressure. Hydraulic and Pneumatic load cells are used for transferring the force into pressure.

8. How we can measure the temperature changes?

Temperature is not measured directly, but is measured through indirect means; change of temperature of a substance causes a variety of effects. These effects may be physical, chemical, electrical (or) optical and they may be used for the measurement of temperature through use of proper temperature sensing devices.

9. Tell some thing about 'static characteristics' and 'static calibration' in measurements:

'Static characteristics' of a measurement system are in general those that must be considered when the system or instrument is used to measure a condition not varying with time. All the static performance characteristics are obtained in one form or another by a process called' static calibration'

10. What is accuracy and tell about point accuracy?

Accuracy is the closeness with which an instrument reading approaches the true value of the quantity being measured. Thus accuracy of a measurement means conformity to truth.

'Point Accuracy' is the accuracy of the instrument only at one point on it scale.

11. Give the Type of errors in measurements

(i) Gross errors

(ii) Random rrors

(iii) systematic errors

- Instrumental errors
- Environmental errors
- Observational errors

12. Differentiate Gross error and Instrumental Error

Gross errors mainly cover human mistakes in reading instruments and recording and calculating measurement results.

Instrumental Error occurs due to the wrong adjustments of a measuring devices while it construction or misalignments of its pats.

13. Differentiate environmental and systematic errors

Environmental errors causes due to the surrounding condition of instruments, but systematic errors causes because of the fault of the arrangement of measuring system during the whole measuring process.

14. What absolute static error? Give example

Absolute static error is the difference between measured values of quantity and the true value of quantity. ie, Eo= X(m) - X(t)

Example: an error of 2mm is negligible when the length being measured is of the order of (1000 mm) 1 m but the same error of 12 mm may be considerable when the measurement of 10mm length.

15. What do you mean by limiting errors?

The limits of the deviations from the specified values of measurement datas are defined as `Limiting errors' (or) `Guarantee error'

16. Determine relative limiting error:

The relative error (fractional error) is defined as the ratio of the error to the specified magnitude (nominal magnitude) of a quantity.

Relative limiting error $(Er) = \frac{A}{As} = \frac{\text{Limiting error}}{\text{A Normal Value}}$

17. What is an uncertainty in a measurement?

Un certainty of measurement is a parameter associated with the result of measurement, that characterizes the dispersion of values that could be reasonably attributed to the measurand.

18.Define static sensitivity

the static sensitivity of an instrument or an instrumentation system is the ratio of the magnitude of the output quantity to the magnitude of input)quantity being measured)

19. Define scale range:

The scale range of an instrument is defined as the difference between the largest and the smallest reading of the instruments.

20. What is the frequency range in measurements?

Frequency range is defined as frequency over which measurements can be performed with a specified degree of accuracy.

21. What is extensometer?

Extensometer is an instrument used top measure minute deformation of material while it is subjected to a stress.

22. Classify the extensometers depending upon the magnification systems.

1. Mechanical Extensometers
2. Optical extensometers
3. Acoustical (Vibrating wire) extensometers
4. Electrical extensometers
5. Pneumatic extensometers.

23. What are the Basic Requirements of extensometer?

1. Very high magnification:The magnification required is usually greater than 1000: 1
2. Sensitivity: The relation between input and output should not be affected by the reversal in the direction of input and this requires that the movement should not have any friction.
3. Low input force: The input force required to cause displacement should be extremely small thus there is no defamation of the component due to the process of measurement.

24. Classify the mechanical extensometers depending upon the manner of obtaining the magnification.

1. Wedge magnification
2. Screw magnification
3. Compound magnification
4. Lever magnification

25. Give the disadvantages of a simple mechanical lever magnification

For strain measurements on inner surfaces of small structures, the clearance may be in sufficient for the gauge and all its auxiliary equipment.

26. Give the magnification capacity & gaugelength of Huggen-Berger tensometer

The magnification may vary from 300 to 2000 depending upon the model. The gauge length varies from 12.5 to 25 mm.

27. Give the advantages of scratch gauge

1. Compact in size
2. It can be attached to almost any surface with clamps or screws & adhesive bonding
3. It can measure scratch under all types of loading (static, shock, fatigue)
4. It can be used to record stress in all types of environments.

28. Tell something about the magnification capacity of Marten's extensometer

This instrument is extremely sensitive and by using telescope, regarding may be estimated to 1/10 mm which corresponding to a length charge of approximately 0.0002m.

29. Give the classifications of Electrical strain gauges

(a) inductance (or) magnetic strain gauges

(b) Electrical resistance strain gauges

(c) The capacitance strain gauges.

30. How strain can be measured by using Electrical strain gauges?

Electrical strain gauge is a device in which a change in length produces a change in some electrical characteristics of the gauges.

31. Give the working principle of inductance strain gauges?

An electrical inductance gauge is a device in which the mechanical quantity to be measured produced a change in the magnetic field, and hence in the impedance of a current carrying coil.

32. Give the working principle of eddy- current gauges

In this types of gauges the losses in the magnetic circuit are varied by changing the thickness or position of the high- loss element inserted in the magnetic field.

33. What is known as foil strain gauges?

The foil strain gauge has metal foil photo- etched in a grid pattern of the electric insulator of the thin resin and gauge leads attached.

34. What is the basic principle of unbonded metallic strain gauges

the principle of unbonded metallic gauges is based on change in electrical resistance of a metallic wire due to change in tension of the wire.

Unit -II

1. What is photo-etching?

Photo etching is the act of producing grid configuration on metal foil with the help of photo effect.

2. What is known as strip gauges?

The number of strain gauges are arranged in a particular manner is called strip gauges.

3. What is known as strain rosettes?

An arrangement of strain gauges in particular orientation or angle is known as strain rosettes

4. Give the quantities required for a good gauge material?

High gauge factor

High resistance

Low temperature

sensitivity

High electrical stability

Good corrosion

resistance

High yield point stability

5. Give some arrangements of strain gauges to obtain strain rosettes

1. Two gauge rosette
2. Rectangular rosette
    a) Three element
    b) Four element
3. Delta (or) Equiangular rosette
4. T. Delta rosette

6. What are the methods are available for computing the strain rosette datas?

1. Analytical Solutions
2. Graphical Solutions
3. Semi ± graphical (or) vectorial layout method
4. Nomographic Solutions
5. Geometrical Computers.

7. Give the advantages of strain Rosette analysis.

(i)Extreme simplicity and speed of application.

(ii)Possibility of allowing for transverse effects.

(iii)No requirements for additional equipments.

(iv) The possibility of training relativity unskilled persons to use the method.

8.Give the type of strain gauge circuits.

1. Wheat stone bridge circuits for static strain measurements.
2. Potentiometer circuits for dynamic strain measurements.

9. Define sensitivity of potentiometer:

Sensitivity of the potentiometer circuit is defined as the ratio of the output voltage divided by the strain.

UNIT III

1. Define Light

Light is usually defined as the radiation that can affect the human eye.

2. Define White light:

Light from a source that emits a continuous spectrum with equal energy for every wave length is called white light.

3. Define monochromatic light:

Light of a single wave length is called monochromatic light. Example: sodium vapour lamp, Hg arc lamp.

4. What is wave front?

The focus of points on different radial lines from the source exhibiting the same disturbance at a given instant of time, in a surface known as a wave front.

5. Define Ray?

A line normal to the wave front, indicating the direction of propagation of the waves is called a ray.

6. What are longitudinal waves?

The waves in which vibration are along the direction of their travel is known as longitudinal waves.

7. What are transverse waves?

Transverse waves are waves in which vibrations are perpendicular to the direction of wave travels.

8. What is polarized light?

The light having vibration only along a single straight line perpendicular to the direction of propagation of light is said to be polarized.

9. What is plane of polarization?

The plane containing the direction of propogation of light, but containing no vibrations is called the plane of polarization.

10. What are the methods are available to obtain plane polarized light?

(i) Refraction and Reflection for glass plate.

(ii) By using Nichol Prism.

11. What are the disadvantages are available in Nichol prism when we use that to obtain plane polarized light?

1. Costly
2. Intensity is Poor.

12. What is the basic principle for photo elasticity?

When polarized light enters a loaded transparent component, it is split into two beams both beams travel along the same path, but each vibrates along a principal direction and travels at a speed proportional to the associated principal stress.

13. What is Refractive index?

The ratio of the velocity of light In air to the velocity in the medium is called the refractive index of the medium and is denoted by `n' .

14. What do you mean by Polariscope?

Polariscope is an optical instrument that utilizes the properties of polarized light in its operation.

15. Give the types of polariscopes used in experimental stress analysis?

(i) Plane Polariscope

(ii) Circular Polariscope

16. Give the four different possible setups in circular polariscope?

Setup	Polariser- Analyzer	Quarter wave plates	Field
1	Crossed	Parallel	Bright
2	Crossed	Crossed	Dark
3	Parallel	Crossed	Bright
4	Parallel	Parallel	Dark

17. What is known as isotropic point in a polariscope setup?

In a particular point in a stressed model where $\sigma_1=\sigma_2$, that fringe order is zero and permanent block dots appear at these points such are called isotropic points.

18. What are the properties of photo elastic materials?

1. Transparent to light used in the Polariscope.
2. Easily machinable by conventional means.
3. It should be force form residual stresses
4. They should have both mechanical and optical isotropy and homogeneity.

19. Give the most commonly used methods for compensation techniques

1. Babinet compensation method.
2. Babinet soleil compensation method
3. Tension or compression stop method.
4. Tardy method of compensation.
5. Senarment method of compensation
6. Photometric method.

20. What are the techniques used to determine the stresses at the inner layers of the body in 3D photo elasticity?

1. Locking in the stresses in the model
2. Multilayer reflection technique.

Unit - IV

1. Define Non - destructive testing

Non ±destructive testing is a technique for revealing flaws and defects in a material or device without damaging as destroying the test sample.

2. Give some advantages of NDT:

1. Can be done directly on production items without regards to part cost or quantity available.

2. Can be done on 100% of production of on representative samples.

3. Give the limitations of NDT:

1. Results often must be interpreted by a skilled. Experienced technician.

2. In absence of contact with each other, different observers may disagree on meaning & significance of test results.

4. Give the advantages of Radiographic inspection.

- The ability to detect internal flows
- An ability to detect significant variations in composition.
- Permanent recording of raw inspection datas.

5. Give some advantages of Brittle coating method.

- Provides nearly whole field area
- Is non destructive if the coating is sensitive enough.
- Is simple to analyze

6. Give some advantages by using fiber optic sensors.

- Light weight (very small in size)
- Low power requirement
- Resistant to electromagnetic interference
- High sensitivity