Odisha University of Agriculture and Technology
External Theory Examination
Experimental Stress Analysis (CE 505)

Time : 2 hrs. Full Marks: 35

Answer all questions from Group A and any three questions from Group B

Group A (28 x 0.5 = 14 Marks)

True or false

1. Stress transformation can also be viewed as relating stresses on different planes that pass through a point.
2. There are three shear stress components in a 3-D stress system..
3. Principal plane is the plane in which shear stress is maximum.
4. In a Mohr's circle shear stress is drawn on the x-axis and normal stress on the y-axis.
5. Principal stress is also a minimum stress.
6. Shear strain is zero on plane of maximum principal strain.
7. External axial force must be collinear and pass through the centroid of a homogeneous cross section for no bending to occur.
8. Behaviour of the brittle coating is independent of temperature variation
9. Mohr's circle for tri-axial stress system is similar to bi-axial stress system.
10. At a point in plane stress, the principal stresses from the equation were found to be 5 MPa and -20 MPa. That means the major principal stress is 5 MPa.

Fill up the blanks

11. In a general two dimensional stress system, planes of maximum shear stress are inclined at _____ with principal planes.
12. Stresses at a point are 90MPa tensile and 20MPa compressive in orthogonal directions. _____ is the average stress at the point.
13. A bar is subjected to axial load such that its length L is increased by 0.001 L. If Poisson's ratio is 0.3, then the change in diameter is _____d.
14. Observation made in three directions from a three-element rectangular rosette are $\varepsilon A = +800\ \mu$ cm/cm $\varepsilon B = -400\ \mu$ cm/cm, and $\varepsilon C = -860\ \mu$ cm/cm. The direction A is along X-axis. Then _____ is the strain in the Y-axis?
15. Minimum strain required to crack a particular grades of stress coat is 550 μ strain. If Ec = 1.4 GPa, Stress in the coating is _____.
16. An axially loaded bar is subjected to normal stress of 20 MPa. The maximum shear stress is _____MPa.

17. _____ is linearly proportional to the loads in photoelasticity.
18. Visible light waves varies from _____ nm to _____ nm.
19. Relative retardation of light wave is measure using _____ equipment.
20. 10mm square grid marking on a surface changed to 10.125 mm x 9.9075mm rectangle. _____ and _____ are the longitudinal and lateral strains, respectively.

Match the followings

21.	Grid method	**a.**	$\varepsilon_z = 0$
22.	Brittle coating	**b.**	Bifringes
23.	Strain rosette	**c.**	Index of refraction
24.	Plane stress	**d.**	Surface marking
25.	Plane strain	**e.**	T-delta
26.	Photo elasticity	**f.**	Pre-determined stress
27.	Intermediate principal stress	**g.**	$\sigma_z = 0$
28.	Moiré method	**h.**	3D stress

s

Group B (3 x 7 = 21 Marks)

1) Four element strain rosette was used to measure strain on a foot of a machine. Measurement results recorded from the rosette are ε_a = 65 μm/m, ε_b = 700 μm/m, ε_c = 150 μm/m and ε_d = 75 μm/m. Using the measurement results calculate ε_x, ε_y and Υ_{xy}. Calculate also the principal stresses and planes. Use E = 205 GPa and υ = 0.29.
2) The state of stress at a point is given by the following array of terms

$$\begin{bmatrix} 20 & 5 & 3 \\ 5 & 10 & 4 \\ 3 & 4 & 15 \end{bmatrix}$$

Determine the normal and shear stresses on a plane whose direction cosines are -0.7, 0.6, and 0.2.

3) Describe the concepts of photoelastic photography. How fractional fringe order can be determined by the photographic method?
4) What are the various types of brittle coating available? Discuss their important features.
5) At a point in plane strain, the strain components are ε_{xx} = 200 μ m/m, ε_{yy} = 1000 μ m/m and γ_{xx} = -600 μ m/m, Determine the (a) principal strains and principal angles (b) the maximum shear strain (c) the strain component in a coordinate system that is rotated 25^o counterclockwise.