**Registration No :** | | | | | | | | | | |

**Total Number of Pages : 03** **B.Tech.**
**PCI4I101**

**4th Semester Regular / Back Examination 2017-18**
**ADVANCED MECHANICS OF SOLIDS**
**BRANCH : CIVIL**
**Time : 3 Hours**
**Max Marks : 100**
**Q.CODE : C769**

**Answer Part-A which is compulsory and any four from Part-B.**
**The figures in the right hand margin indicate marks.**
**Answer all parts of a question at a place.**

**Part – A (Answer all the questions)**

**Q1** **Answer the following questions: *multiple type or dash fill up type*** **(2 x 10)**

**a)** For design of ductile material, ------ theories is/are used,
i) Maximum shear stress theory ii) Shear strain energy theory
iii) Both i) and ii) iv) None of the above

**b)** A circular bar is subjected to an axial force and shear force, the difference between two principle stresses is 120 MPa. Based on maximum shear stress theory what is the factor of safety, if elastic limit of the bar is 300 MPa?
i) 2 ii) 2.5 iii) 3 iv) 5

**c)** According to maximum strain energy theory, failure of material due to complex stresses occurs when total stored energy per unit volume at a point ----------.

**d)** In maximum principle strain theory, maximum principal strain for no failure condition is ----------

**e)** In unsymmetrical bending, the deflection curve is------ in the plane of applied moment.

**f)** Bending stress in a curved beam varies --------with the distance from neutral axis.

**g)** A thick cylinder under external fluid pressure' $p_i$ will have maximum stress at the ----------

**h)** ---------- is an example of plane strain problem

**i)** Which of the following reduces the stress concentration?
i) Use of multiple notches ii) Drilling additional holes
iii) Removal of undesired material iv) Each of the mentioned

**j)** A quarter wave plate induces a phase shift equal to------

**Q2** **Answer the following questions: *Short answer type*** **(2 x 10)**

**a)** Define octahedral shear stress.

**b)** Show graphical representation of maximum principal stress theory.

**c)** Explain direction of neutral axis in unsymmetrical bending.

**d)** Write the relation between $I_x$, $I_y$, $I_{xy}$, $I_u$ and $I_v$ for a beam with unsymmetrical section.

**e)** Define shear centre.

**f)** Show shear flow on symmetrical sections.

**g)** Explain plane stress.

**h)** Define stress cocentration factor.

**i)** What is the function of wave plate?

**j)** Draw a neat sketch of a plane polariscope.

## Part – B (Answer any four questions)

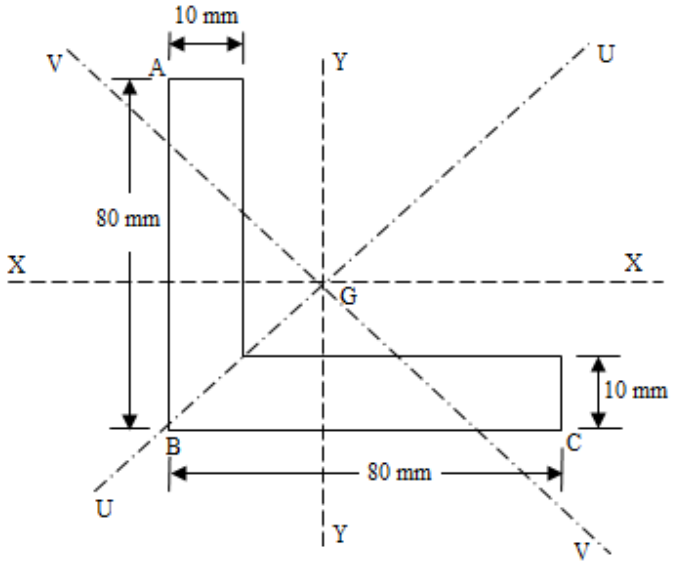
**Q3** **a)** If principal stresses at a point in an elastic material are 2f tensile, f tensile, 0.5 f compressive, calculate the value of f at failure according to five different theories. The elastic limit in simple tension is 200 N/mm$^2$ and poisson's ratio is μ=0.3. **(10)**

**b)** Write notes on compound cylinders. **(5)**

**Q4** **a)** The load on a bolt consists of an axial pull of 10 kN together with a transverse shear of 5 kN. Estimate the diameter of bolt required according to following theories of failure **(10)**
a) Maximum principal stress theory
b) Maximum shear stress theory
c) Maximum strain energy theory

**b)** Explain graphical representation of maximum strain theory. **(5)**

**Q5** **a)** An angle section as shown in Fig below is used as a simply supported beam over a span of 2.4 m. It carries a load of 500 N along the line YG, where G is the centroid of the section. Calculate (i) stresses at the points A, B and C of the mid-section of the beam, (ii) deflection of the beam and its direction with the load line and (iii) position of the neutral axis. Take E = 210 GPa. **(10)**




**b)** Show the three dimensional stresses on a cubical element and derive the equilibrium equation in the direction of X axis. **(5)**

**Q6** **a)** Derive the equation to calculate the value of '*m*' for a rectangular section having width '*b*', depth '*h*' and radius of curvature *R*. The value of '*m*' is required to calculate bending stress of the curved beam section with large initial curvature. **(10)**

**b)** A curved beam with eccentricity 0.02D is loaded with 1kN.Centroidal radius=4D and inner and outer radii are 3.5D and 4.5D respectively. Area of cross section is 0.8D². Find the dimension D if allowable stress is 110N/mm².Considering only bending stress. **(5)**

**Q7** **a)** A rectangular strain-rosette is used to measure the strains at a point *B*. The values read at a stage of experiment are $e_x$= 400 micron, $e_y$= -100 micron and $e_{45}$= 200 micron. If modulus of elasticity *E* = 2.07 × 10$^5$ N/mm$^2$ and Poisson's ratio μ = 0.3. Find the principal stresses and their directions. **(10)**

**b)** Explain isochromatic fringe pattern. **(5)**

**Q8** **a)** A crane hook whose horizontal cross section is trapezoidal, 50 mm wide at the inside and 25 mm wide at the outside, thickness 50 mm, carries a vertical load of 1000 kg whose line of action is 38 mm from the inside edge of this section. The centre of curvature is 50 mm from the inside edge. Calculate the maximum tensile and compressive stresses set up. **(10)**

**b)** Explain light and dark field in a polariscope. **(5)**

**Q9** **a)** An external pressure of 12 MPa is applied to a thick cylinder of internal diameter 160 mm and external diameter 300 mm. If the maximum hoop stress permitted on the inside wall is 40 MPa: **(10)**

a) The maximum internal pressure that can be applied and

b) The change in outside diameter if the cylinder has closed ends.

Take E = 205 GPa and Poisson's ratio = 0.25

**b)** Discuss resistance strain gauges. **(5)**