Registration No :

Total Number of Pages : 02

B.Tech
PCI4I101

4th Semester Regular / Back Examination 2018-19
ADVANCED MECHANICS OF SOLIDS
BRANCH : CIVIL
Max Marks : 100
Time : 3 Hours
Q.CODE : F478

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I
Q1   **Only Short Answer Type Questions (Answer All-10)**   (2 x 10)
- a) State maximum shear stress theory.
- b) Distinguish between plane stress and plane strain conditions.
- c) Differentiate between thick and thin cylinder.
- d) What do you mean by endurance limit?
- e) Write differential equations of equilibrium.
- f) Define shear centre.
- g) A thick cylinder is subjected to external pressure. What will be the nature of circumferential stress and where it will be maximum?
- h) What is polar moment of inertia of a circular cross section of diameter d.
- i) Define stress concentration factor.
- j) Name the type of cross section of a beam which can never be subjected to unsymmetrical bending.

Part- II
Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)
- a) At a point in a bar of cast iron, the principal stresses are 60 MPa tensile and 120 MPa compressive whereas the third principal stress is zero. Find the factor of safety based on the elastic limit when the criterion of failure is principal stress theory. Assume the elastic limit of cast iron is 90 MPa in tension and 440 MPa in compression.
- b) Derive the differential equation of equilibrium for plane stress problem in the presence of body forces.
- c) A thick cylinder 10 cm inside diameter and 20 cm outside diameter is subjected to an internal fluid pressure of 60 N/cm^2. Calculate the tangential stresses at the inside and outside surfaces.
- d) Compare the various theories of failure graphically.
- e) The load on a bolt consists of an axial pull of 15 kN together with a transverse shear of 7.5 kN. Determine the diameter of the bolt according to
  - (i)   Maximum shear stress theory.
  - (ii)   Strain energy theory.
- f) A cantilever beam of rectangular cross section is subjected to a load of 1000N at free end. The length, breadth and depth of the beam are 400cm, 4cm and 6cm respectively. The line of action of the load makes 30^0 with the vertical. Determine the maximum stress in the beam.
- g) Explain the Winkler-Bach theory as applicable to bars of large initial curvature.
- h) Differentiate between symmetrical bending and unsymmetrical bending in detail.

i) What are meant by the terms *principal axis*, *principal moment of inertia* and *product of inertia*.

j) Write a short note on polariscope.

k) Write a short note on repeated stresses and fatigue in metals.

l) Using a 60°strain rosette the following strains have been determined at a point on the surface of a machine base. Assuming x-axis corresponds to 0°, find the strain components along x-axis and y-axis. $\varepsilon_o=40\times10^{-6}$, $\varepsilon_{60}=980\times10^{-6}$, $\varepsilon_{120}=330\times10^{-6}$.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Determine the location of shear centre O of a thin-walled beam of uniform thickness having cross section as shown in figure below. **(16)**
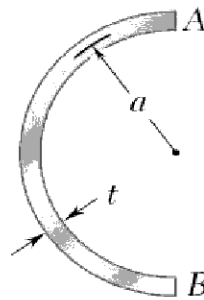
Q4 A compound cylinder is made of an inner steel cylinder with internal and external radii of 80 mm and 90 mm respectively encased inside another cylinder made of copper with outer radius 100 mm. The combination has a shrink fit of 2 mm. If the Young's modulus and Poisson's ratio of steel and copper are as given below, find the pressure developed due to shrink fit. **(16)**
E_s =210 GPa, μ_s=0.3, E_c =210 GPa, μ_c=0.3 .

Q5 For the crane hook shown in the figure below determine the largest tensile stress in section a-a. **(16)**

Section *a-a*
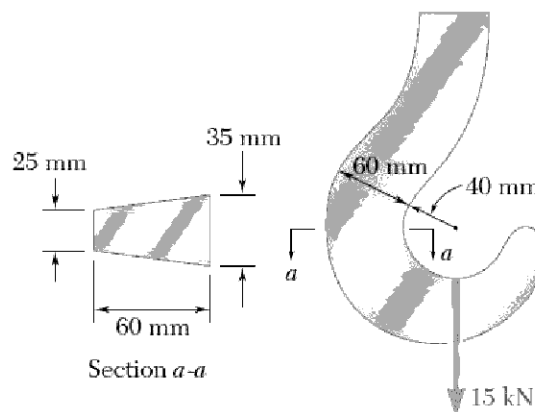
Q6 What is a strain rosette? Derive an expression of three element delta rosette for principal strains and principal stresses. **(16)**