Registration No. :

Total number of printed pages – 3

Fifth Semester Regular Examination – 2014
ADVANCED MECHANICS OF MATERIALS
BRANCH : CIVIL
QUESTION CODE : H 162
Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2×10

    (a) What do you mean by proof stress ?

    (b) Distinguish between plane stress and plane strain conditions.

    (c) Calculate the polar moment of inertia of a circular section of diameter, d.

    (d) What do you mean by plastic moment ? What is the plastic moment value
         for a simply supported beam of span, L carrying a concentrated load,
         W at the centre of span ?

    (e) State Castigliano's 1st theorem.

    (f) What do you mean by endurance limit ?

    (g) State the assumptions of Euler beam theory.

    (h) Distinguish between impact load and dynamic load.

    (i) What do you mean by endurance limit ?

   (j) Differentiate between symmetrical bending and unsymmetrical bending.

2. A cantilever beam of 3 m long supports an inclined point load of 2.5 KN at
    the free end. The beam cross section is an I section with total depth of
    200 mm and flange width of 100 mm. The thickness of both flange and web
    is 6 mm. Find the maximum stress at the extreme corners if the angle of
    inclination of the load is 50 with the vertical. Consider E = 200 GPa.   10

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3. The bent bar shown below has a circular cross section of diameter 50 mm. The inner radius of the semicircular part is 25 mm and length of the rectangular part is 75 mm. If allowable tensile strength is 55 MPa, find the value of P. 10
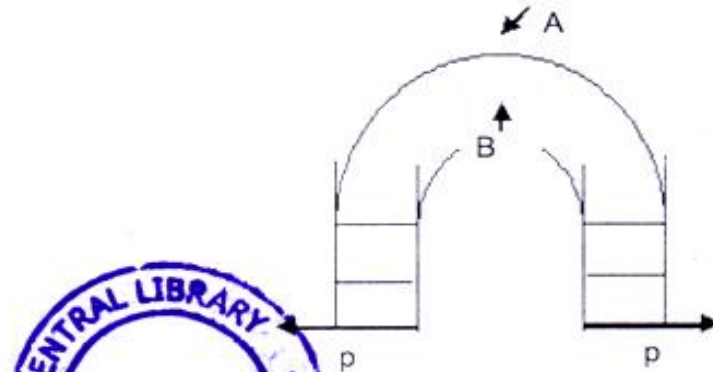
4. Find the shear center of the following unequal I section. The thickness of both flanges and web is 8 mm. 10
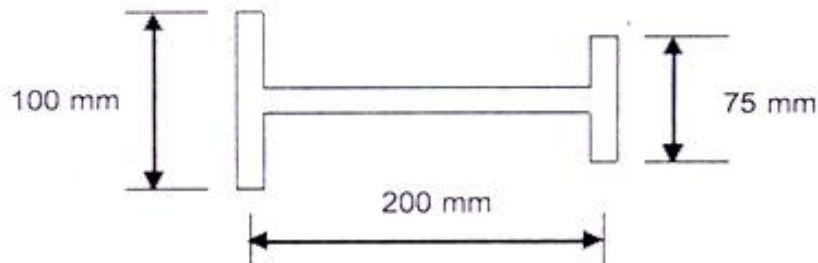
5. A compound cylinder is made of an inner steel cylinder with internal and external radii of 80 mm and 90 mm respectively encased inside another cylinder made of copper with outer radius as 100 mm. The combination has a shrink fit of 2 mm. If the Young's modulus and Poisson's ratio of steel and copper are as given below, find the pressure developed due to shrink fit. $E_s = 210$ GPa$\mu_s = 0.3$, $E_c = 110$ GPa, $\mu_c = 0.3$. 10

6. A large spherical tank of inner diameter of 16 m contains gas at a pressure of 3.0 MPa. Determine the required thickness of the container if the yield stress of the material is 490 MPa and Poisson's ratio of 0.3 for a factor of safety of 2.5. Use maximum principal stress theory and maximum shear stress theory. 10

7. On the surface of a structural component in a space vehicle, the strains are monitored by means of a 60° strain rosette (delta rosette) and the following strains are recorded in a certain manoeuver. $\epsilon_a = 1100 \times 10^{-6}$, $\epsilon_b = 200 \times 10^{-6}$, $\epsilon_c = 200 \times 10^{-6}$, Determine the principal strains and stresses in the material, which is a magnesium alloy with $E = 0.5 \times 10^5$ MPa and Poisson's ratio $\mu = 0.35$.   10

8. Write short notes on any three the following :   3.33×3

   (a) Compound cylinders

   (b) Stress optic law

   (c) Equations of equilibrium and compatibility

   (d) Repeated stresses and fatigue in metals.