B.Tech 4th Semester Mid-Term Examination, 2018

MECHANICS OF SOLIDS-I

Subject Code: 011X06

Time: 2 hours **Full Marks: 20**

Instructions:

(i) Attempt any three questions.
(ii) Question No. 1 is compulsory.

1. Chose the correct option of the following (any five)

(a) For a linear elastic isotropic material, the number of independent elastic constant (s) is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(b) The ratio of Young's Modulus of Rigidity (G) for a material having Poisson's ratio 0.2 is

(i) 12/5

(ii) 5/14

(iii) 5/12

(iv) 14/5

(c) For a given material $E = 2G$, then the bulk modulus (K) 0f the material will be

(i) $E/3$

(ii) E/L

(iii) E/A

(iv) E

(d) The variation of bending moment in a beam, where load is UDL is

(i) Linear

(ii) Parabolic

(iii) Cubic

(iv) Zero

(e) A mild steel bar of uniform cross-section *A* and length *L* is subjected to an axial load *W*. the strain energy stored in the bar should be

(i) $WL/2AE$

(ii) $W^2L/4AE$

(iii) $WL/4AE$

(iv) $W^2L/2AE$

(f) The bending moment for a certain portion of the beam is constant, for that section, the shear force would be

(i) Constant

(ii) Zero

(iii) Increasing

(iv) Decreasing

(g) A rectangular element is subjected to given state of stress with axes X-Y and element is rotated with an angle α, is having own state of stress with a new plane X'-Y'. Find the value of normal stress $\sigma_{x'x'}$ in new plane X'-Y'.

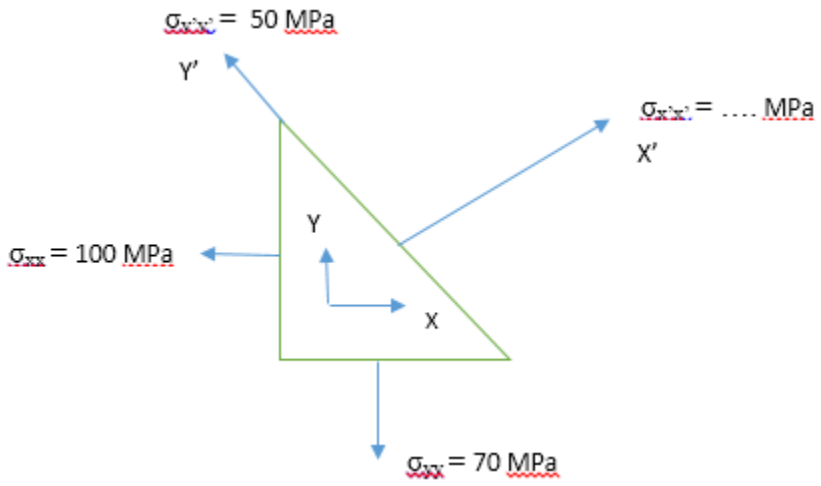

Figure-1

2. A slightly tapered bar AB of circular cross-section and length *L* is supported at the end B and subjected to a load *P* at the free end. The diameters of the bar at the ends A and B are d_1 and d_2 respectively. Derive a formula for the elongation at the bar due to the load *P*.

OR

3. A cylindrical piece of steel 80 mm diameter and 120 mm long, is subjected to an axial compressive force of 5000 kg. Calculate the change in volume of the piece if bulk modulus K is 1.7 x 10^6 kg/cm^2 and Poisson's ratio = 0.3

4. Draw shear force and bending moment diagram for a beam as shown in figure below, and locate point of contraflexure if any.

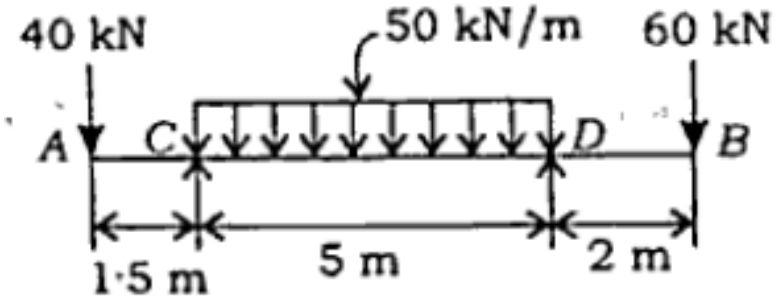

Figure-2

OR

5. **(a)** Define strain energy and derive expression in case of uniaxial loading. Also define resilience, proof resilience (Modulus of resilience) and modulus of toughness.

   (b) What is relationship between all elastic constants (write only expressions).

BEST OF LUCK