

Roll No.

Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(Automation & Robotics) (2011 & Onward) (Sem.-3)

STRENGTH OF MACHINE ELEMENTS

Subject Code : BTAR-304

M.Code : 63004

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A**Q1. Answer briefly :**

- (a) Define Lateral strain.
- (b) Give the expression relationship between Young's modulus and Bulk modulus.
- (c) Differentiate between a composite system and a composite bar.
- (d) Define factor of safety and give its importance.
- (e) Define principal planes.
- (f) State assumption made in theory of simple bending.
- (g) Define polar moment of inertia.
- (h) Define helical springs.
- (i) Enumerate the assumptions made in Euler's column theory.
- (j) Define strut.

SECTION-B

- Q2. Determine the changes in length, breadth and thickness of a steel bar which is 4 m long, 30 mm wide and 20 mm thick and is subjected to an axial pull of 30 kN in the direction of its length. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.3.

- Q3. A flat steel flat bar of 20 mm x 10 mm is fixed with aluminum flat of 20 mm x 10 mm so as to make a square section of 20 mm x 20 mm. The two bars are fastened together at their ends at a temperature of 26°C. Now the temperature of whole assembly is raised to 55°C. Find the stress in each bar. Take $E_s = 200\text{GPa}$, $E_a = 70\text{ GPa}$. $\alpha_s = 11.6 \times 10^{-6}/^\circ\text{C}$, $\alpha_a = 23.2 \times 10^{-6}/^\circ\text{C}$.
- Q4. An I section shown in figure below, is simply supported over a span of 12m. If the maximum permissible stress is 80 N/mm^2 , what concentrated load can be carried out at a distance of 4 m from one support?

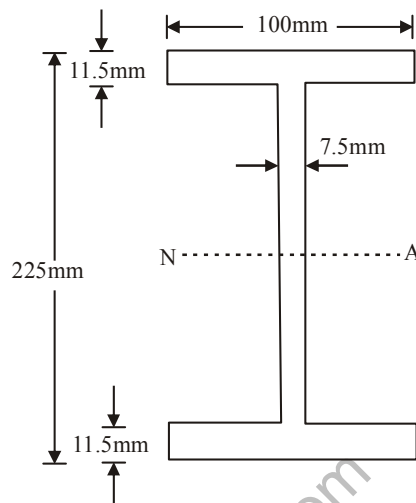


FIG.1

- Q5. Two shafts of same material and of same lengths are subjected to the same torque. If the first shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is $2/3$ rd of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the two shafts.
- Q6. Determine the Euler's crippling load for a T section of dimensions $10\text{ cm} \times 10\text{ cm} \times 2\text{ cm}$ and of length 5 cm, when it is used as strut with both ends hinged. Take Young's modulus for the joist as $2.0 \times 10^5\text{ N/mm}^2$.

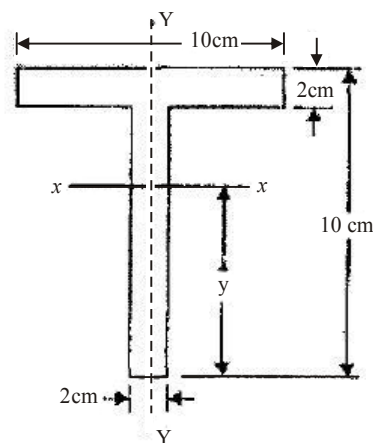


FIG.2

SECTION-C

- Q7 (a) A bolt is acted upon by an axial pull of 16 kN along with a transverse shear force of 10 kN. Determine the diameter of the bolt required according to different theories of failure. Elastic limit of the bolt material is 250 MPa and a factor of safety of 2.5 is to be taken along with Poisson's ratio of 0.3.
- (b) At a point in a strained material, the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of major principal axis. Also determine the maximum shear stress at the point.
- Q8. A simply supported beam AB of span 4 m carries a point load of 100 kN at its centre C. The value of I for the left half is $1 \times 10^8 \text{ mm}^4$ and for the right half portion I is $2 \times 10^8 \text{ mm}^4$. Find the slopes at the two supports and deflection under the load. Take $E = 200 \text{ GN/mm}^2$.

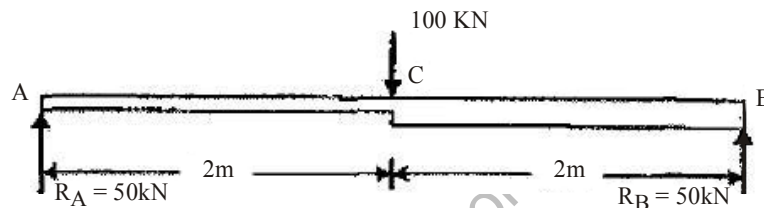


FIG.3

- Q9. The beam AC is simply supported at A and C and subject to the uniformly distributed load of 300 N/m plus the couple of magnitude 2700 N-m as shown in Figure. Write equations for shearing force and bending moment and make sketches of these equations.

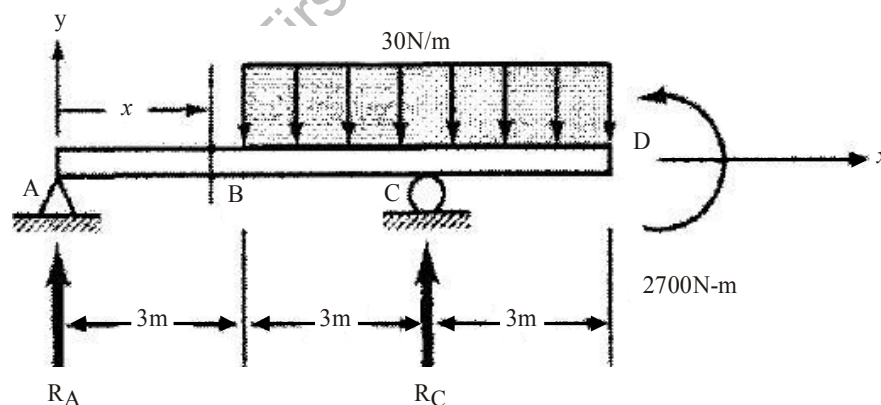


FIG.4

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.