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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 Eular'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 $E = 2 \times 10^5$ 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 × 10 mm so as to make a square section of 20 mm × 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 = 200GPa, E_a = 70 GPa. $\alpha_s = 11.6 \times 10^{-6}$/°C, $\alpha_a = 23.2 \times 10^{-6}$/°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?

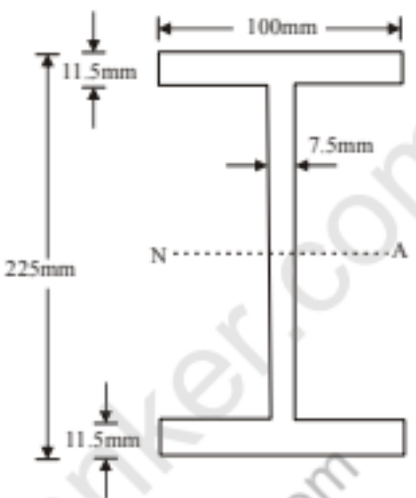

FIG.1

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 2/3rd 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 Eular's crippling load for a T section of dimensions 10 cm × 10 cm × 2 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 × 10^5 N/mm^2.

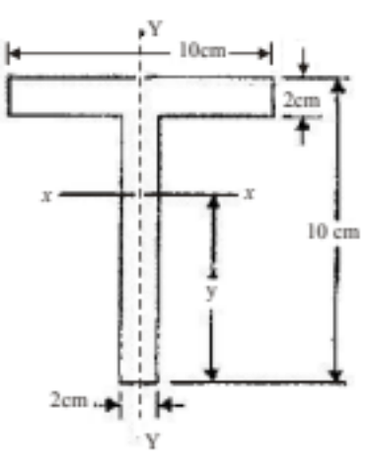

FIG.2

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 1×10^8 mm^4 and for the right half portion I is 2×10^8 mm^4. Find the slopes at the two supports and deflection under the load. Take E = 200 GN/mm^2.

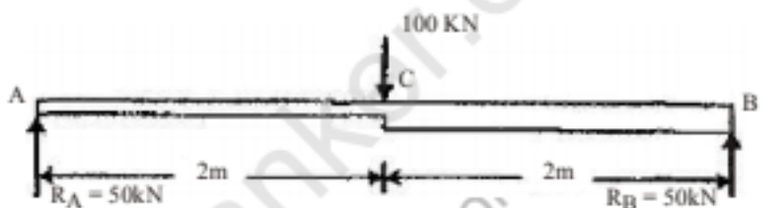

FIG.3

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.

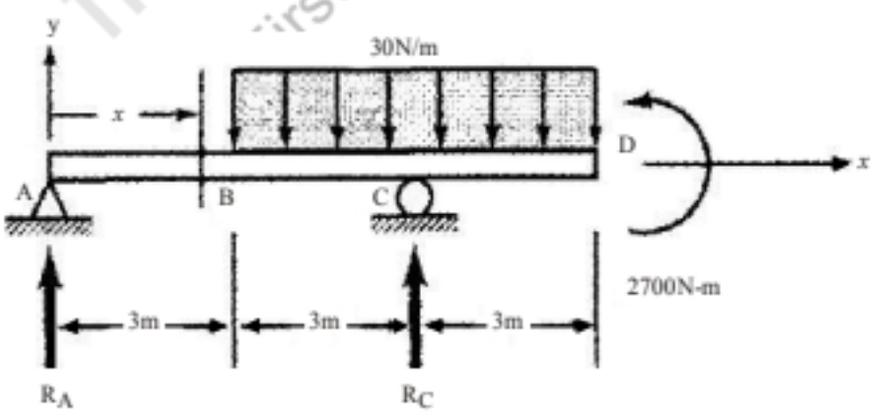

FIG.4

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.