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Total Number of Pages: 02

B.Tech.
PAU31101

3rd Semester Regular / Back Examination 2017-18

MECHANICS OF SOLID

BRANCH: AUTO

Time: 3 Hours

Max Marks: 100

Q.CODE: B792

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: *multiple type or dash fill up type* (2 x 10)

- a) The maximum stress produced in a bar of tapering section is at.....
- b) A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar will induce.
Tensile stress (b) compressive stress (c) no stress
- c) The bending moment at a point on a beam is the algebraic of all the moments on either side of the point
- d) The stress induced in a body, when suddenly loaded, is the stress induced when the same load is applied gradually
- e) If the slenderness ratio for a column is 100, then it is said to be a column.
- f) A vertical column has two moments of inertia (i.e. I_{xx} and I_{yy}). The column will tend to buckle in the direction of the.....
- g) Euler's formula holds good only for.....column
- h) In the torsion equation $\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{l}$ the term J/R is called.....
- i) When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the.....layer.
- j) The point of contra flexure is a point where.....

Q2 Answer the following questions: *Short answer type* (2 x 10)

- a) What do you mean by volumetric strain and how it is related to the diametral strain of sphere?
- b) What is proof stress?
- c) How is thermal stress different from ordinary stress?
- d) What is principal plane?
- e) What are 'neutral axis' & 'neutral plane'?
- f) What is flitched beam and what are its advantages?
- g) What is a thermal stress?
- h) What are stiffness & toughness?
- i) Define the terms 'slenderness ratio' and 'buckling load'?
- j) Draw the stress-strain curve for ductile material and shows the important points.

Q3 a) A 200 mm diameter CI pipe has thickness of 12 mm and is closely wound with a layer of 5 mm diameter steel wire under a tensile stress of 60 N/mm². If now water under pressure 4 N/mm² is admitted into the pipe, find the stresses developed in pipe and stress wire. (10)

(Take for pipe $E_c = 1 \times 10^5$ N/mm², $\nu = 0.3$, for steel $E_s = 2 \times 10^5$ N/mm²)

b) What is strain energy and how it is differ from resilience? (5)

- Q4** a) Establish the relation between Young's modulus (E), modulus of rigidity (G) and bulk modulus (K). (10)
b) Draw the SF and BM diagram when a uniform distributed load act on the simple supported beam. (5)
- Q5** a) A timber beam 15 cm x 20 cm is to be reinforced with two steel flitches 10 cm x 1cm in section. Compare the moments of resistance when the flitches are top and bottom and attached symmetrically on the sides. (10)
(Take $E_s = 200$ GPa, $E_t = 10$ GPa)
b) Explain what you understand by 'beam of uniform strength', and how can it can be achieved? (5)
- Q6** a) A hollow shaft of diameter ratio $\frac{3}{8}$ is required to transmit 600 kW at 110 rpm, the maximum torque being 20 % greater than the mean. The shear stress is not exceed to 63 MN/m². And angle of twist in length of 3 meters not to exceed 1.4° . Calculate the required external diameter of shaft. (10)
b) Explain what is equivalent bending moment, when shaft is subjected to both BM (M) and torsion (T). (5)
- Q7** a) Determine the expression for maximum slope and deflection of cantilever beam carrying (a) concentrated load 'W' at its free end (b) uniform distributed load w along its whole length. (10)
b) What is 'wahr's correction factor'? Explain (5)
- Q8** a) Derive an expression for crippling load for the column, when one end of the column is fixed and other end is hinged. (10)
b) A T-section (150x120x20mm) is used as column of 4 m. length with hinged at both ends. Calculate the crippling load. (Take $E = 2 \times 10^6$ Kgf/cm²) (5)
- Q9** a) A steel tube 24 mm external diameter and 18 mm internal diameter encloses a copper rod 15 mm diameter to which it is rigidly joined at each end. Calculate the thermal stresses in the rod and tube with rise in temperature by 150° C. (10)
(Take $E_s = 210$ GPa, $E_c = 100$ GPa, $\alpha_s = 11 \times 10^{-6}/^\circ$ C, $\alpha_c = 18 \times 10^{-6}/^\circ$ C)
b) Derive an expression for the deflection of closed coil helical spring, subjected to an axial load 'W'. (considering the effect of torsion only) (5)