Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech.**
PME3I101

3rd Semester Regular / Back Examination 2017-18
MECHANICS OF SOLID
BRANCH: MECH
Time: 3 Hours
Max Marks: 100
Q.CODE: B795

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/mm^2. If now water under pressure 4 N/mm^2 is admitted into the pipe, find the stresses developed in pipe and stress wire. **(10)**
(Take for pipe E_c= 1x10^5 N/mm^2, γ=0.3, for steel E_s= 2x10^5 N/mm^2)
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 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/m^2. And angle of twist in length of 3 meters not to exceed 1.4^0 . 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 'wahrl'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 X 10^6 Kgf/cm^2) **(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 150^0 C. **(10)**

(Take E_s= 210 GPa, E_c=100 GPa, α_s= 11 x 10^{-6}/ ^{0} C, α_c= 18 x 10^{-6}/ ^{0} 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)**