Total No. of Questions—**8**] [Total No. of Printed Pages—**5**

Seat No.	

[5352]-515

S.E. (Mech/Auto) (I Sem.) EXAMINATION, 2018
STRENGTH OF MATERIALS
(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.
(*ii*) *All four* questions should be solved in one answer-sheet.
(*iii*) Figures to the right indicate full marks.
(*iv*) Neat diagrams must be drawn wherever necessary.
(*v*) Use Graph Paper for Graphical Solution.
(*vi*) Use of Logarithmic Tables, Slide Rule, Mollier Charts, Electronic Calculator and Steam Tables is allowed.
(*vii*) Assume suitable data, if necessary.

Que 01 a) Rigid body AB weighing of 40 kN hangs from three wires of equal lengths as shown in ***Fig. No.- 01***. The middle wire is of steel and two outer wires are of copper. If cross sectional area of each wire is 250 mm^2. Calculate load sheared by each wire. Take E_{st} *=210 GPa,* E_{cu}*=120 GPa.* 06 M

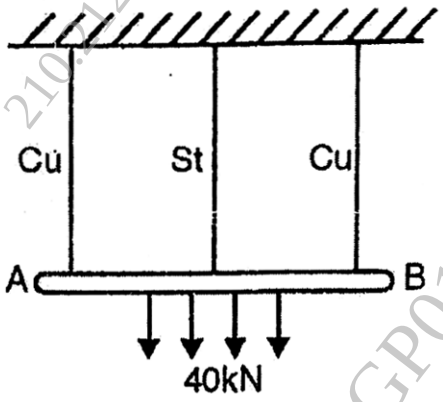

Fig No.- 01

b) A cantilever beam is fixed at D and is subjected to point loads and moments as shown in ***Fig No. -02.*** Draw SF and BM Diagram for the same. 06 M

P.T.O.

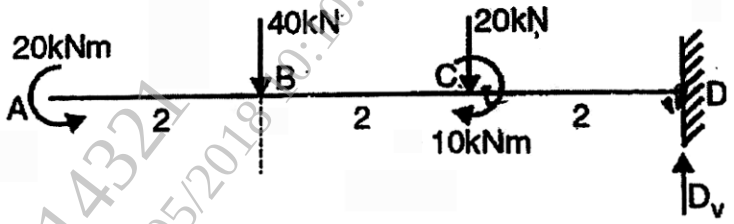

Fig No. -02

OR

Que 02 a) Three rods each of length 1 m and cross sectional area 200 mm^2 are connected to a rigid plates at the ends as shown in ***Fig. No.- 03***. If the temperature of the assembly is raised by 25^0 C, determine stress in each rod.

Take E_{st}=200 GPa, α_{st}=12 X 10^{-6} per ^{0} C

E_{cu}=120 GPa. α_{cu}=18.5 X 10^{-6} per ^{0} C 06 M

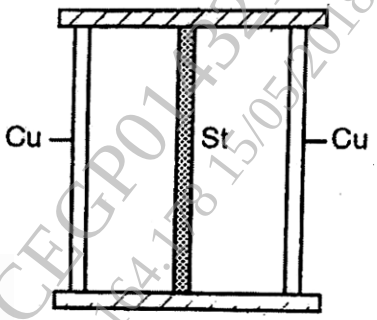

Fig. No.- 03

b) A beam 5 m long and simply supported at each end, has a uniformly distributed load of 1000 N/m extending from left end to the point 2 m away. There is also a clock wise couple of 1500 N-m applied at the center of beam. Draw the SF and BM diagram for the beam. 06 M

Que 03 a) A beam having a cross section in the form of channel as shown if ***Fig. No. 04*** is subjected to bending moment acting about X-X axis. Calculate the thickness' **t'** of the channel in order that the bending stresses at the Top and Bottom layer of the beam C/S will be in the ratio 7 : 3. 06 M

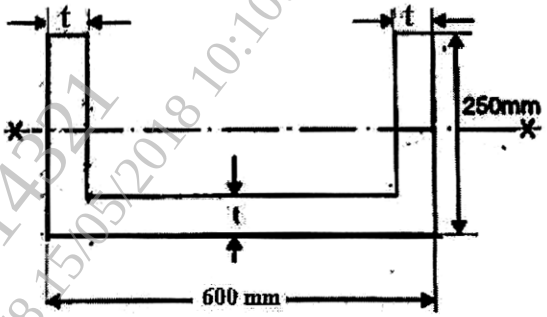

Fig. No. 04

b) The horizontal beam as shown in ***Fig. No 05*** is hinged at point 'A' and supported on roller at point 'B'. It carries a vertical load of 120 kN at point 'D'. Determine deflection at point 'D' by taking E = 200 GPa and I = 160 X 10^6 mm^4 06 M

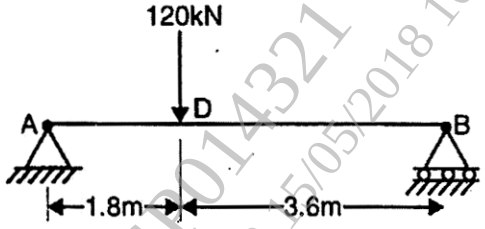

Fig. No 05

OR

Que 04a) A beam having 'T' shaped cross section with flange 200 mm X 50 mm and web 50 mm X 200 mm & I = 1.134 x 10^8 mm^4, is subjected to a vertical shear force of 100 kN. Calculate shear stress at

1. Bottom and Top Layer
2. Neutral axis
3. Junction layer of web and flange
4. Junction layer of flange and web

also draw shear stress distribution diagram showing stress at above stated layers 06 M

b) A cantilever beam 'AB' is fixed at end 'A' on left and supports two concentrated loads of 10 kN and 5kN at point 'C'& point 'B' respectively. 06 M

Point 'C' and ' B' are at a distance of 1.3 m and 2.6 m respectively from point 'A'. Calculate deflection of point 'C' from its original position by taking E = 200 GPa and I = 20.1 X 10^6 mm^4

Que 05 a) A hallow circular shaft has an external diameter of 120 mm and an internal diameter of 100 mm. The maximum permissible shear stress is 100 MPa and twist is not to exceed 3.6^0 in length of 3 m. Maximum torque is 25 % more than the average torque. The shaft is rotating at 2 RPS. If shear modulus is 80 GPa, find safe power that can be transmitted. 07 M

b) An alloy tube of 25 mm internal diameter and 40 mm external diameter, when subjected to an axial tensile force of 60kN undergoes an extension of 3.84 mm over its 3 m length. What is its safe axial load resisting capacity (i. e. working load) as a column when one end is fixed and other is hinged? Take F. O. S. 4 06 M

OR

Que 06 a) A composite shaft consists of a steel rod 60 mm diameter surrounded by closely fitted tube of brass fixed to it. Find outside diameter of tube so that when torque is applied to the composite, it will be shared equally by the two materials. Take G for steel = 8.4 X 10^4 N/mm^2 and G for brass = 4.2 X 10^4 N/mm^2. If the torque is 10,000 Nm find the maximum shearing stress in each material and the angle of twist in a length of 4 meters. 07 M

b) A cylindrical tube having internal diameter 70 mm and external diameter 80 mm is used on a column. The section is subjected to an axial load of 100 kN. Determine whether the tube is safe for the given application. Use Rankine formula with Rankine's constant a= (1/7500), E = 200 GPa, Yield stress = 150 MPa, & Effective length of column = 4.5 m. 06 M

Que 07 An machine element is loaded as 75 MPa tensile stress in X-direction, 100 MPa tensile stress in Y-direction and 50 MPa shear stress in anticlockwise direction on

x-face. Determine following stresses using graphical method proposed by Mohr. Mohr's circle must be drawn by using suitable scale on graph paper only

I. The principal stresses and their orientation

II. The maximum shearing stresses and direction of the plane on which it occur 13 M

OR

Que 08 a) A circle of 40 mm diameter is marked on steel plate before it is stressed as shown in ***Fig. No. 06***. As a result of these stresses the circle deforms to an ellipse. Calculate the lengths of major and minor axis of an ellipse and their directions. Assume E = 200 GPa and $\mu = 0.25$ 07 M

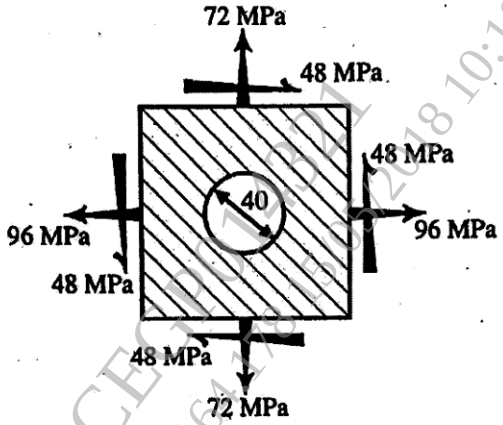

Fig. No. 06

b) A member, solid circular in cross section is subjected to an axial pull of 13 kN and a shear force of 5 kN Design cross section of member based on –

I. Maximum principal stress theory

II. Maximum shear stress theory

Take

Elastic limit of axial tension = 250 MPa and

Poisson's Ratio $\mu = 0.3$ and F. O. S. = 2.5 06 M