b) Discuss the concept of transmission shaft under combine bending and torsion.

8. Write a short notes on:
   a) Elastic constant
   b) Maximum distortion energy theory

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Total No. of Questions : 8] *[Total No. of Printed Pages : 4*

Roll No .....

AU/ME-221

B.E., III Semester

Examination, December 2016

Choice Based Credit System (CBCS)

Strength of Materials

Time : Three Hours

Maximum Marks : 60

Note: i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Assume suitable data if necessary.

1. a) A steel bar is placed between two copper bars each having the same area and length as the steel bar and placed at 15°C. At this stage they are rigidly connected together at both the ends. When the temperature of the assembly is raised to 315°C, the length of the bars increases by 1.5mm. Determine the original length and the final stresses in the bars. Take Es = 2.1×10^5 N/mm^2, Ec = 1.0×10^5 N/mm^2. $\alpha s = 0.000012$ per °C and $\alpha c = 0.0000175$ per °C.

   b) At a point in a stressed body the principal stresses are 100 MN/m^2 (tensile) and 60 MN/m^2 (compressive). Determine the normal stress and shear stress on a plane inclined at 50° to the axis of major principal stress. Also calculate max. shear stress at the point.

2. a) What are shear force and bending moment diagrams?

   b) A beam of I-section 500mm deep and 190mm wide has flanges 25mm thick and web 15mm thick. It carries a shearing force of 400kN at a section. Calculate the maximum intensity of shear stress in the section assuming the moment of inertia to be $6.45 \times 10^8 mm^4$. Also calculate the total shear force carried by the web.

3. a) Explain the moment areas method for finding slope and deflection in beams.

   b) A cantilever beam 2 meter long carries a point load of 1kN at the free end and a uniformly distributed load of 2kN/meter over a length of 1.25 meter from the fixed end. Find the deflection at the free end if E = 200GPa. Take moment of inertia $I = 138.24 \times 10^6 mm^4$

4. a) A solid shaft of 200mm diameter is proposed to be replaced by a hollow shaft of external diameter two times the internal diameter. If same power is to be transmitted at the same speed and at same level of shear stress. Find the size of hollow shaft.

   b) Derive the torsion at equation

   $\frac{T}{J} = \frac{fs}{r} = \frac{C\theta}{L}$ with usual notations. Also state the assumption mode.

5. a) Derive Euler equation for buckling of column hinged at both ends.

   b) A hollow cast iron column of external diameter 200mm length 4 metre with both the ends fixed, supports an axial load 800kN. Find the thickness of the material required use Rankine's constant $a = \frac{1}{6400}$ and a working stress = $80 N/mm^2$

6. a) Calculate the maximum value of the slenderness ratio for which the Euler's formula is valid. For steel take maximum permissible stress and modulus of elasticity as 330 MN/m^2 and 210 MN/m^2 respectively.

   b) Explain the Mohr's circle method for finding the location of principal planes and the magnitudes of principal stresses.

7. a) The state of stresses in a strained material is shown below in figure. Find graphically

   i) Principal planes

   ii) Principal stresses

   iii) Normal stress, shear stress and the resultant stress on the planes the normal of which are inclined at +30° with the axis.