Reg. No. : | | | | | | | | | | |

Question Paper Code: 31314

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Third Semester

Civil Engineering

01UCE304 - MECHANICS OF SOLIDS - I

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define Poisson's ratio. And give its value for concrete.
2. State the relation between the elastic modulii.
3. List out the methods employed for analyzing the pin jointed frames.
4. What do you mean by moment of inertia?
5. Write the assumptions in theory of simple bending.
6. Draw the shear force and bending moment diagram for simply supported beam carrying udl throughout the span.
7. Define torsion and write torsion equation.
8. Classify the springs employed for various purposes.
9. Define principal stresses and principal planes.
10. Write the uses of Mohr's circle.

PART - B (5 x 16 = 80 Marks)

11. (a) A compound bar consists of a central steel strip 40*mm* wide and 5*mm* thick placed between two strips of brass each 40*mm* wide and *x mm* thick. The strips are firmly fixed together to form a compound bar of 40*mm* wide and *(2x+5)mm* thick.

Determine the thickness of brass strips which will make the apparent modulus of elasticity of bar equal to $160x10^3$ MN/m^2. (16)

Or

(b) A steel bar is placed between two copper bars each having the same area and length as the steel bar at 15^oC. At this stage they are rigidly connected together at both the ends. When the temperature is raised to 315^oC, the length of the bar increases by 2*mm*. Determine the original length and final stresses in bars. Take $E_S = 220\ GN/m^2$, $E_C = 110\ GN/m^2$, $\alpha_s = 0.000012$ *per* ^oC and $\alpha_c = 0.0000175$ *per* ^oC. (16)

12. (a) A girder freely supported at ends is loaded as shown in figure 1. Find the forces in the members. (16)

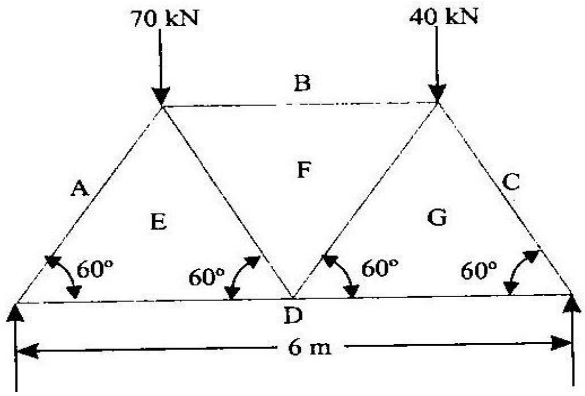

Figure 1

Or

(b) Locate the centroid of the hatched area show figure 2. (16)

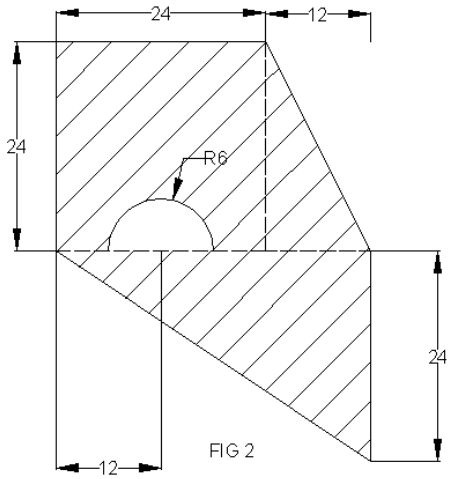

Figure 2

13. (a) A beam of length 10 *m* is simply supported at ends and carries point loads of 5 *kN* each at a distance of 3 *m* and 7 *m* from the left support and also a UDL of 1 *kN/m* between the point loads. Draw the shear force and bending moment diagram for the beam. (16)

Or

(b) Derive the bending equation $\frac{M}{I} = \frac{E}{R} = \frac{f}{y}$. (16)

14. (a) A hollow shaft, having an inside diameter 60% of its outer diameter, is to replace a solid shaft transmitting the same power at the same speed. Calculate the % saving in material, if the material to be used is also the same. (16)

Or

(b) A closed coiled helical spring is to have a stiffness of 100 *N/m* in compression, with a maximum load of 45*N* and a maximum shearing stress of 120 N/mm^2. The solid length of the spring is 45*mm*. Find the wire diameter, the mean coil radius and the number of coils. (16)

15. (a) A short metallic column of 500 mm^2 cross section area carries an axial compressive load of 100 *kN*. For a plane of inclined at 60° with the direction of loads, calculate: 1) normal stress 2) tangential stress 3) resultant stress 4) maximum shear stress 5) obliquity of the resultant stress. (16)

Or

(b) A cylinder (500 *mm* internal diameter and 20 *mm* wall thickness) with closed ends is subjected simultaneously to an internal pressure of 0.60 *MPa*, bending moment 64000 *Nm* and torque of 16000*Nm*. Determine the maximum tensile stress and shearing stress in the wall. (16)