Unit III

5. 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 to exceed 63 MPa and the twist in a length of 3 m not to exceed 1.4 degrees. Calculate the maximum external diameter satisfying these conditions. **15**

6. A railway wagon weighing 40 kN and moving with a speed of 8 km/hr is stopped by a buffer of 4 helical springs whose allowable maximum compression is 150 mm. Find out the number of turns in each spring, if the diameter of the spring wire is 14 mm and the diameter of coil is 80 mm. Assume G = 84 GPa. **15**

Unit IV

7. A beam AB of length '*l*' is simply supported at A and B points. It carries a point load of 'W' at a distance '*a*' from the left end. Find the deflection under the load and the maximum deflection of the beam using Macauly's method. **15**

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B. Tech. EXAMINATION, Dec. 2018

(Third Semester)

(B. Scheme) (Main & Re-appear)

(AE)

AE205B

MECHANICS OF SOLIDS

Time : 3 *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. Each question carries 15 marks. Candidate may use only non-programmable scientific calculator. Assume suitably any missing data, if any.

Unit I

1. A steel tie rod 50 mm in diameter and 2.5 m long is subjected to a pull of 100 kN. To what length, the rod should be bored centrally so that the total extension will increase by 15% under the same pull, the bore being 25 mm diameter. Assume E = 200 GPa. **15**

2. A vertical compound member fixed rigidly at its upper end consists of steel rod 2.5 m long and 20 mm diameter placed within an equally long brass tube of 21 mm internal diameter and 30 mm external diameter. The rod and tube are fixed together at the other ends. The compound member is then suddenly loaded in the tension by a weight of 10 kN falling through a height of 3 mm on to a flange fixed to its lower end. Calculate the maximum stress in the steel and brass. Assume E_{steel} = 200 GPa and E_{Brass} = 80 GPa. **15**

Unit II

3. A beam ACDEFB is simply supported at points A and B. The beam has two concentrated point loads at points C and point F which are 1.0 kN and 4.0 kN respectively. Besides this, the beam carries UDL of 2 kN/m over the DE span of the beam. Assume AC = 1.0 m, CD = 1.0 m, DE = 2.0 m, EF = 1.0 m and FB = 1.0 m. Draw the SF and BM diagrams for the beam and find out the magnitude and position of the maximum BM taking place in the beam. **15**

4. A cast iron water main pipe 12 m long of 500 mm inside diameter and 25 mm wall thickness runs full of water and is supports at its ends. Calculate the maximum stress in the metal, if the density of cast iron is 7200 kg/m^3 and that of water is 1000 kg/m^3. **15**

8. Direct stresses of 120 MPa (tension) and 90 MPa (compression) are applied to an elastic material at a certain point on planes at right angles to another. If the maximum principal stress is not to exceed 150 MPa in tension, to what shear stress can material be subjected ? What is then the maximum resulting shearing stress in the material ? Also find the magnitude of the other principal stress and its inclination to 120 MPa stress. **15**

8. Direct stresses of 120 MPa (tension) and 90 MPa (compression) are applied to an elastic material at a certain point on planes at right angles to another. If the maximum principal stress is not to exceed 150 MPa in tension, to what shear stress can material be subjected ? What is then the maximum resulting shearing stress in the material ? Also find the magnitude of the other principal stress and its inclination to 120 MPa stress. **15**