(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0429 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2012-13

STRENGTH OF MATERIALS

Time : 3 Hours *Total Marks : 100*

Note : *(1) Attempt **all** the questions.*

(2) Assume suitable value for missing data, if any.

1. Attempt any **two** parts : **(10×2=20)**

(a) At a point in a material there are normal stresses of 30 N/mm^2 and 60 N/mm^2 tensile, together with a shearing stress of 22·5 N/mm^2. Find the value of principal stresses and the inclination of the principal planes to the diection of the 60 N/mm^2 stress.

(b) Discuss different Theories of Failure. Graphically represent these theories.

(c) A weight W = 5 kN attached to the end of a steel wire rope moves downward with constant velocity 1 m/s. What stresses are produced in the rope when its upper end is suddenly stripped ? The free length of rope at the moment of impact is 20 m, its net cross-sectional area is 10 sq cm. and E = 2·00×10^5 N/mm^2.

2. Attempt any **two** parts : **(10×2=20)**

(a) A simply supported beam AB carrying a load P at the

middle point C, has cross-sectional moment of inertia I over the left half of the span and 2I over the right half. Using the Moment Area method, find the angle of rotation θ_A and θ_B of the end tangents and the deflection δ_c under the load P.

(b) A hollow steel shaft 10 cm external diameter, 5 cm internal diameter, transmits 600 kN at 500 rpm and is subjected to an end thrust of 60 kN. Find what bending moment may be safely applied to the shaft if the greater principal stress is not to exceed 100 N/mm^2.

(c) A timber beam 5 cm wide by 7 cm deep is to be reinforced by bolting on two steel flitches, each 5 cm by $\frac{1}{2}$ cm in section. Calculate the moment of resistance when the flitches attached symmetrically at top and bottom. What is the maximum stress in the steel ? $E_s = 2{\cdot}1\times10^5$ N/mm^2, $E_t = 1{\cdot}4\times10^4$ N/mm^2.

3. Attempt any **two** parts : **(10×2=20)**

(a) Find the mean radius of an open coiled spring of helix angle 30°, to give a vertical displacement of 23 mm and an angular rotation of the load end of 0·02 radians under an axial load of 35 N. The material available is steel rod 6 mm diameter. $E = 2\times10^5$ N/mm^2, $G = 8{\cdot}0\times10^4$ N/mm^2.

(b) What are leaf springs ? Find proof load and maximum bending stress in a semi-elliptic type leaf spring.

(c) What are the limitations of Euler Theory for buckling ? Discuss Rankine-Gordon formula.

4. Attempt any **two** parts : **(10×2=20)**

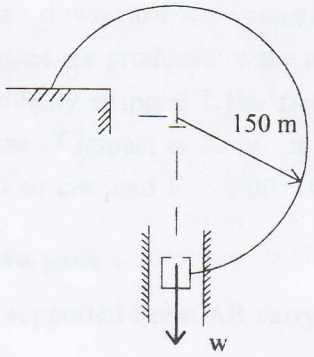
(a) A thin cylinder 150 mm internal diameter, 2·5 mm thick, has its end closed by rigid plates and then filled with water. When an external axial pull of 37 kN is applied to the ends the water pressure is observed to fall by 0·1 N/mm^2. Determine the value of Poisson's ratio. E = 1·4×10^5 N/mm^2, K = 2200 N/mm^2.

(b) The maximum stress permitted in a thick cylinder of inner and outer radius of 10 cm and 15 cm is 20 N/mm^2. The external pressure is 8 N/mm^2; what internal pressure can be applied ?

(c) Find the expression for stresses induced in a long cylinder rotating with angular speed w.

5. Attempt any **two** parts : **(10×2=20)**

(a) Fig. shows a steel rod of 12 mm diameter with one end fixed into a horizontal table. The remainder of the rod is bent into the form of three quarters of a circle and the free end is constrained to move vertically. Determine the vertical deflection for a load of 10 kg. E = 208,000 N/mm^2.



(b) Discuss unsymmetrical bending slope of neutral axis and stresses induced.

(c) A curved bar of square section 4 cm sides and mean radius of curvature 5 cm is initially unstressed. If a bending moment of 300 Nm is applied to bar to straighten it, find the stresses at the inner and outer faces.