Printed Pages : 4 EME-302

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

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

B. Tech.

(SEMESTER-III) EXAMINATION, 2012-13

MECHANICAL ENGINEERING

STRENGTH OF MATERIAL – II

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt questions from **all** sections as directed.

SECTION – A

1. Attempt **all** the questions : **10 × 2 = 20**

   (a) Define principle stresses and principle plane.

   (b) Name any four theories of failure.

   (c) Define point of contra flexure. In which beam it occurs.

   (d) Define springs. Name the different types of springs ?

   (e) What are the limitations of Euler's theory of columns ?

   (f) Define hoop stress and longitudinal stress ?

   (g) What is the maximum shear stress of a thin spherical pressure vessel of mean radius R and wall thickness h, under internal pressure p ?

   (h) Write down the expression for power transmitted by shaft.

   (i) Differentiate between straight and curved beam.

   (j) Define unsymmetrical bending.

SECTION – B

2. Attempt any **three** questions : **3 × 10 = 30**

   (a) Direct stress of 120 MN/m^2 in tension and 90 MN/m^2 in compression are applied to an elastic material at a certain point on a plane at 25° with the tensile stress. If the maximum principal stress is not to exceed 150 MN/m^2 in tension to what shearing stress can the material be subjected ? What is then the maximum resulting shearing stress in the material and also find the magnitude of the other principal stress and its inclination to plane of 120 MN/m^2 stress.

(b) A beam having T section is shown in Fig. 1 with its flanges of (180 mm × 10 mm) and web of (220 mm × 10 mm) is subjected to sagging bending moment 15 kN-m. Determine the maximum tensile stress and maximum compressive stress.

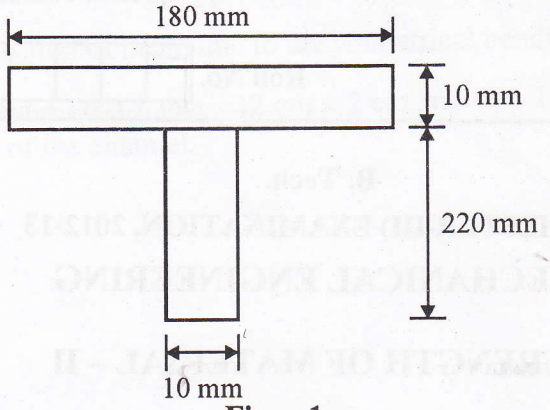

Fig. – 1

(c) Two helical springs are nested one inside the other to support a load of 500 N. Both the springs are made of the same material with modulus of rigidity $G = 82.7 \times 10^3$ MPa. the particulars of the springs are tabulated below :

SN	Parameters	Outer Spring	Inner Spring
1	Mean coil diameter (D)	40 mm	28 mm
2	Diameter of the spring wire (d)	5 mm	4 mm
3	No of active coil (I)	10	8
4	Free Length	90 mm	78 mm

Determine the (i) deflection of each beam, (ii) Load carried by eah spring, and (iii) shear stress induced in each spring.

(d) Derive the expressions for circumferential and radial stress in the wall of thick cylinder (Lame's equation).

(e) A ring carrying a load of 30 kN is shown in Fig. 2, Calculate the stress at positions 1 and 2.

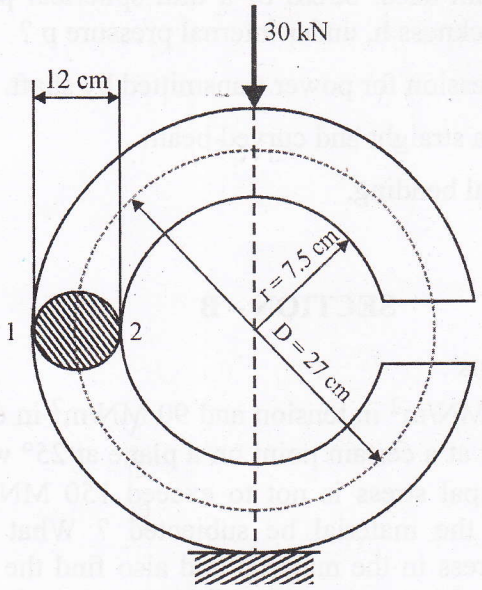

Fig. – 2

SECTION – C

Answer **all** the questions with internal choice :

3. Attempt any **two** questions : **(2 × 5 = 10)**

   (a) Explain maximum normal shear stress and shear stress theory.

   (b) Explain Impact load and impact stress.

   (c) Explain in brief Macaulay's method, equation of equilibrium involves three-dimensional stress systems.

4. Attempt any **one** question : **(1 × 10 = 10)**

   (a) Derive deflection equation for cantilever beam carrying a concentrated load at the free end.

   (b) A solid shaft rotating at 500 rpm transmits 300 kW. The maximum torque is 20% more than mean torque. Material of shaft has the allowable shear stress of 65 MPa and modulus of rigidity of 81GPa, the angle of twist in the shaft should not exceed 1° in 1 meter length. Determine the diameter of the shaft.

5. Attempt any **one** question : **(1 × 10 = 10)**

   (a) Define slenderness ratio and derive Euler's expression for bucking load for column with both ends hinged.

   (b) A 1.5 m long Cast Iron (C.I.) column has a circular cross section of 5 cm diameter. The one end of the column is fixed and other end is free. By taking a factor of safty as 3, find the safe load on column by using;

      (i) Rankine-Gordon formula; using yield stress as 560 MN/mm^2 and a = 1/1600 for pinned end.

      (ii) Euler's formula; assume Young's modulus for C.I. as $120GN/m^2$.

6. Attempt any **one** question : **(1 × 10 = 10)**

   (a) A thin spherical shell one meter in diameter with its wall of 1.2 cm thickness is filled with a fluid at atmospheric pressure. What intensity of pressure will be developed in it if 175 cm^2 more fluid is pumped into it ? Also calculate the circumferential stress at that pressure and increase in diameter and volume of the vessel. Taking E = $200GN/m^2$ and Poisson's ratio as 0.3.

   (b) An external pressure of 10 MN/m^2 is applied to thick cylinder of internal diameter 150 mm and external diameter 300 mm. If the maximum hoop stress permitted on the inside wall is 35 MN/m^2, calculate the maximum internal pressure that can be applied.

7. Attempt any **two** questions : **(2 × 5 = 10)**

(a) Explain stress due to unsymmetrical bending.

(b) Explain deflection of beam due to unsymmetrical bending.

(c) A channel section has flanges 12 cm × 2 cm and web 16 cm × 1 cm. determine the shear center of the channel.
