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B.Tech. (Mechanical Engineering) (Sem.–4)

STRENGTH OF MATERIALS-II

Subject Code : BTME-403-18

M.Code : 77548

Date of Examination : 24-11-2023

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. **Answer briefly :**

   a) What do you understand by terms resilience and proof resilience?

   b) Write Lame's equation and state assumptions made in Lame's theory.

   c) Enlist various assumptions made for analysing stress for bars of large initial curvature.

   d) How do you distinguish between thin and thick pressure shells?

   e) State the most common applications of flat spring.

   f) Which type of stresses are produced in a rotating thin disc of uniform thickness?

   g) Locate the severely stressed plane for a load carrying crane hook. Also justify the response.

   h) State the maximum principal strain theory of failure.

   i) Derive expression for hoop stress developed in the material of a thin spherical shell when subjected to internal fluid pressure.

   j) Find the relation for variation of shear stress in a rectangular section of a beam. Also express it in terms of mean shear stress.

SECTION-B

2. Design a closed coiled helical spring which will deflect 60 mm under a load of 700 N. The radius of the coil is 6 times the wire diameter. The maximum shear stress is not to exceed 8 MPa. G = 80 GPa.

3. A high pressure cylindrical vessel is to be designed to handle an internal pressure of 2.5 N/mm^2. It is made from a 2.5 cm thick plate with a permissible tensile strength of 125 N/mm^2. Find out the maximum diameter of the vessel, when efficiency of longitudinal joint is 90% and that of circumferential joint is 40%.

4. The elastic limit of a mild steel material both in tension and compression is 200 MPa and Poisson's ratio 0.3. Show graphically the safe region as per maximum principal strain theory. From graph comment on the safety of the material when the state of three principal stresses is 40 MPa tensile and 70 MPa compressive and zero.

5. A steam turbine rotor, designed for uniform strength for a stress of 100 MN/m^2, is running at 4000 rpm. If its thickness at the centre is 25 mm and density of its material is 7700 Kg/m^3, then find the thickness of the rotor at a radius of 325 mm.

6. Determine the resultant stresses at P and Q of a circular ring having a saw cut along horizontal diameter as shown in figure 1. Also find the position of the neutral axis.

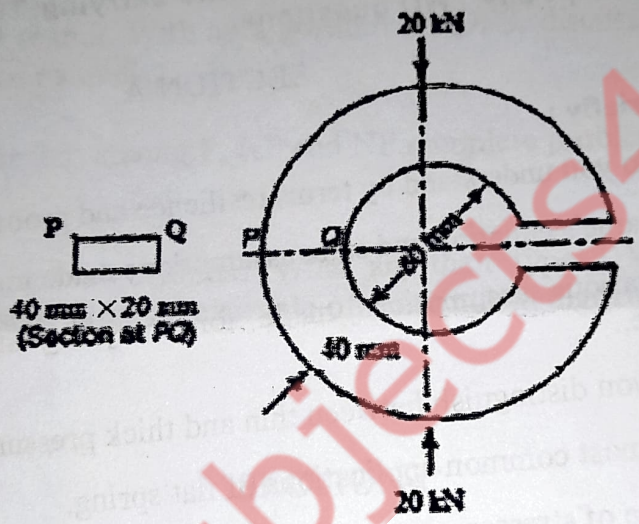

FIG. 1

SECTION-C

7. The maximum permissible stress in a thick cylinder of 550 mm diameter and 100 mm thickness is 15 MPa. Find the maximum allowable internal and external pressures on the cylinder, when applied separately.

8. An I section beam 400 mm×100 mm has a web thickness of 20 mm and a flange thickness of 30 mm. If the shear force acting on the section is 50 kN, find the maximum shear stress developed in the I-section.

9. Deduce an expression for shear strain energy in three-dimensional stress system.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.