Registration No: | | | | | | | | | | |

Total Number of Pages: 04 **B.TECH**

PME5D001

5th Semester Regular Examination 2017-18

Advance Mechanics of Solid

BRANCH: MECH

Time: 3 Hours

Max Marks: 100

Q.CODE: B487

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions: multiple type or dash fill up type** **(2 x 10)**

a) In a thick cylindrical shell subjected to an internal pressure (p), the radial stress across the thickness of the cylinder is

(a) maximum at the outer surface and minimum at the inner surface

(b) maximum at the inner surface and minimum at the outer surface

(c) maximum at the outer surface and zero at the inner surface

(d) maximum at the inner surface arid zero at the outer surface

b) For long columns, the value of buckling load is …….crushing load

(a) equal to

(b) less than

(c) more than

c) A beam of uniform strength is one with

(a) same bending stress at all sections

(b) same bending moment at all sections

(c) same shearing stress at all sections

(d) no shearing stress at any section

d) In a thick cylindrical shell subjected to an internal pressure (p), the maximum radial stress at the inner surface of the shell is

(a) zero

(b) p (tensile)

(c) -p (compressive)

(d) 2p (tensile)

e) In a thick cylindrical shell subjected to an internal pressure (p), the tangential stress is always a tensile stress where as the radial stress is a compressive stress

(a) Correct

(b) incorrect

f) According to Euler's column theory, the crippling load of a column is given by $p = \pi^2 EI/Cl^2$ In this equation, the value of C for a column with both ends hinged, is

(a) 1/2

(b) 1

(c) 2

(d) 1/4

g) Stress concentration factor is ratio of ……..and ……..

h) Elastic strain energy due to axial load is ……

i) Notch sensitivity is ……

j) Shear center is ……

Q2 Answer the following questions: Short answer type (2 x 10)

a) Briefly discuss the theorem of virtual work.

b) Write down the equations for radial and circumferential stresses of a thick cylinder subjected to internal pressure. Also show the distribution of those stresses.

c) What is the difference between 'theoretical stress concentration factor' and 'fatigue stress concentration factor'?

d) Why the trapezoidal cross-section of a crane hook is preferred over a rectangular cross-section?

e) State and explain Maxwell's theorem of reciprocal relation.

f) Write down the advantage of compounding thick cylinder.

g) How are the shear stresses in the flange of a channel section distributed?

h) Find out the equation of elastic strain energy due to torsion.

i) State and explain Castigliano's theorem.

j) Explain Goodman's law. Where it is used?

Part – B (Answer any four questions)

Q3 **a)** Determine by energy method the deflection of the tip of the linear elastic cantilever beam shown in Fig.1 as a result of the point force P. **(10)**

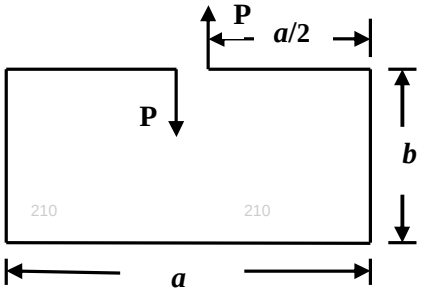


Fig. 1

b) Find out the equation of elastic strain energy due to bending moment. **(5)**

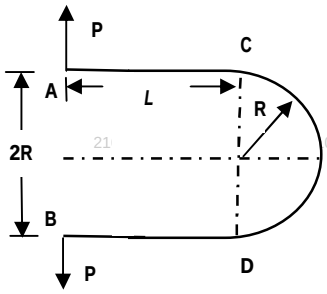
Q4 **a)** A compound tube 100 mm internal diameter and 200 mm external diameter is made by shrinking one tube on to another. After cooling a radial stress of 20 N/mm^2 is produced at the common surface, which is 150 mm diameter. If the tube is now subjected to an internal pressure of 60 20 N/mm^2, find the maximum hoop stress. **(10)**

b) Distinguish between thin and thick cylinders. **(5)**

Q5 **a)** A simple supported beam of rectangular cross-section 10 cm×5 cm has a span of 2.5 m. It rests on the supports such that the 10 cm face makes an angle of 30^o with the horizontal and carries a vertical load of 250 kg at its mid-point. The line of action of the load passes through the centre of area of the section. Calculate (a) the angle which the neutral axis makes with the major principal axis. (b) the maximum bending stress on the beam. (c) the horizontal and vertical components of deflection of the centre of the beam, given that E = 196 × 10^6 kPa. **(10)**

b) Differentiate between symmetrical and unsymmetrical bending. **(5)**

Q6 **a)** Determine the increase in distance between the points C and D of a thin bar of uniform cross-section consisting of a semicircular portion CD and two straight portions AC and BD as shown in the figure. **(10)**



b) Derive the equation for Soderberg's law for fatigue design? **(5)**

Q7 **a)** Derive the formula for bending stress of a curved beam having rectangular cross-section. **(10)**

b) Derive the differential equations of equilibrium in three dimensions. **(5)**

Q8 **a)** What do you mean by compatibility equations? What is its physical significance? **(5)**

b) Derive Saint-Venant's equations of compatibility. **(10)**

Q9 **a)** Locate the shear center of a channel section of mean web length 6 cm and flange width of 3 cm, made of a 3 mm thick sheet. The channel is used to carry a vertical load with its web vertical. **(10)**

b) With neat sketch show the shear stress distribution of a channel section. **(5)**