BT–MRE–III-12.19-1461 Reg. No. | | | | | | | | |

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B.Tech. Degree III Semester Examination in Marine Engineering December 2019

MRE 1304 MECHANICS OF SOLIDS

(2013 Scheme)

Time : 3 Hours Maximum Marks : 100

(5 × 20 = 100)

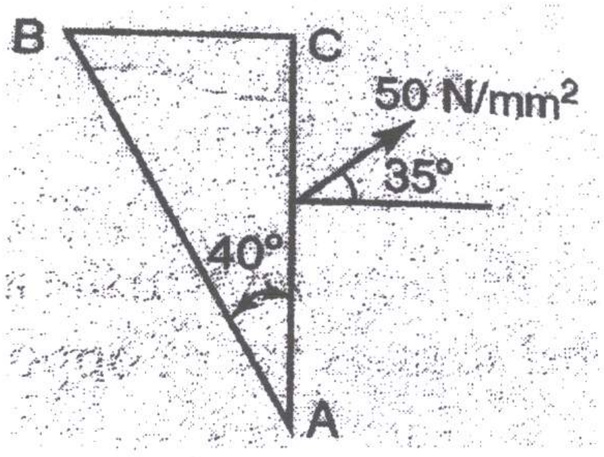
I. (a) Derive the relationship between elastic constants. (5)

(b) A steel flat of thickness 10mm tapers uniformly from 60 mm at one end to 40 mm at other end in a length of 600 mm. If the bar is subjected to load of 60 kN, find its extension. Take E = 2 x 10^5 N/mm^2. What is the percentage error if average area is used for calculating the extension? (15)

OR

II. (a) Explain with necessary sketches application of strain rosettes in experimental stress analysis. (5)

(b) At a point in the vertical cross-section of a beam, there is a resultant stress of 50N/mm^2, which is inclined upwards at 35° to the horizontal. On the horizontal plane through the point, there is only shearing stress. Find the magnitude and direction of the resultant stress on a plane AB which is inclined at 40° to the vertical as shown in figure. (15)



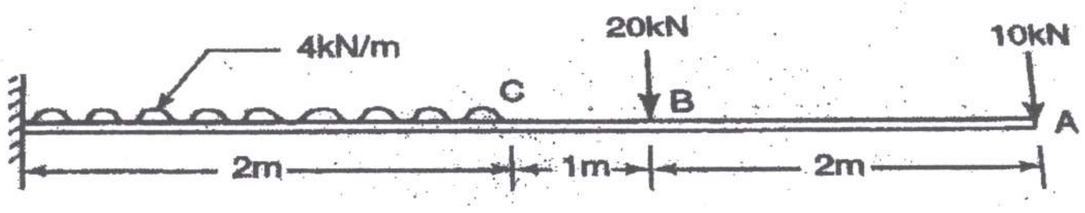
III. (a) Derive the bending equation for a beam subjected to simple bending. (8)

(b) An I section with top flange 80 x 40 mm, web 120 x 20mm and bottom flange 160 x 40 mm. If the tensile stress is not to exceed 30N/mm^2 and compressive stress 90N/mm^2, what is the maximum uniformly distributed load the beam can carry over a simply supported span of 6m if the larger flange is under tension? (12)

OR

IV. (a) Explain the terms shear force, axial force and bending moment. (5)

(b) Draw the shear force and bending moment diagram for the beam given below. (15)



V. (a) A simply supported beam of span 6m is subjected to a uniformly distributed load over the entire span. If the deflection at the centre of the beam is not to exceed 4mm, find the value of the load. Take E = 2x10^5 N/mm^2 and I =300x10^6 mm^4. (5)

(b) Derive the slope and deflection of a simply supported beam carrying uniformly distributed load. (15)

OR

(P.T.O.)

VI. A fixed beam AB of span 6m is carrying a uniformly distributed load of 4kN/m over the left half of span. Find the fixing moments and support reactions. (20)

VII. (a) A hollow propeller shaft of a steam ship is to transmit 3750kW at 240rpm. If the internal diameter is 0.8 times the external diameter and if the maximum shear stress developed is to be limited to 160N/mm^2, determine the size of the shaft. (10)

(b) A composite shaft has an aluminium tube of external diameter 60mm and internal diameter 40mm closely fitted to a steel rod of 40mm. If the permissible stress is 60N/mm^2 in aluminium and 100N/mm^2 in steel, find the maximum torque the composite section can take. Given G_a=27kN/mm^2 and G_s=80kN/mm^2. (10)

OR

VIII. (a) Explain strain energy in torsion. (5)

(b) A close coiled helical spring is required to carry a maximum load of 800N and to have a stiffness of 25N/mm. The mean diameter is to be 75mm. The allowable shear stress =100N/mm^2. Find the suitable diameter of the wire from which to make the spring and the approximate number of turns required. (15)

IX. (a) A thin cylindrical shell 2m long has 200mm diameter and thickness of metal is 10mm. It is filled completely with a fluid at atmospheric pressure. If an additional 25000mm^3 fluid is pumped in, find the pressure developed and hoop stress developed. Find also the changes in diameter and length. Take E=2x10^5 N/mm^2 and μ=0.3. (12)

(b) Explain maximum strain energy theory. (8)

OR

X. A compound cylinders inner radius is 200mm, radius at common surface is 250mm and outer radius is 300mm. Initial pressure at common surface is 6 N/mm^2. What are the final hoop stresses after a fluid is admitted at a pressure of 80N/mm^2 ? Sketch the variation of hoop and radial stresses. (20)

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