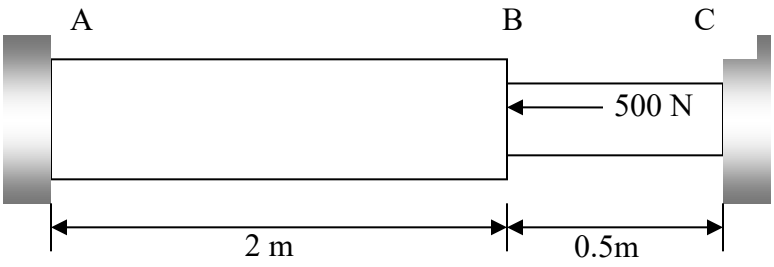
TOPIC

Engineering Mechanics (Statics and Dynamics) – Section VII – Question 2

QUESTION



A composite member ABC made of aluminum (AB) and steel (BC) is shown. A load of 500N is applied at B. Given

$E_{Al} = 70\text{GPa}$ and $E_{st} = 210\text{GPa}$

$A_{Al} = 5\text{cm}^2$ and $A_{st} = 3\text{cm}^2$

The internal force in Newtons in the composite member ABC *just to the right of point* B most nearly is

(A) 60.97 N
(B) 400.00 N
(C) 439.02 N
(D) 500.00 N

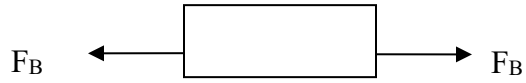
HINT

Draw free body diagrams to the left of *B* and right of *B*
The total elongation of ABC is zero.

SOLUTION

Drawing a free body diagram to the left of B gives

and to the right of B



and the free body diagram of the composite body ABC.

Balance of forces gives

$$F_A - 500 + F_B = 0 \quad (1)$$

The overall elongation of the member ABC is zero,

$$\delta_{ABC} = 0 = \delta_{AB} + \delta_{BC}$$
$$= -\frac{F_A(2)}{5\times10^{-4}(70\times10^9)} + \frac{F_B(0.5)}{3\times10^{-4}(210\times10^9)}$$

$$0 = -5.714 \times 10^{-8}F_A + 1.587 \times 10^{-8}F_B. \quad (2)$$

Solving equations (1) and (2) gives

$F_A = 60.97N$

$F_B = 439.02N$

ANSWER

(C)

CONTRIBUTOR

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