TOPIC
Material Properties

QUESTION
An epoxy matrix is reinforced with 70% glass fibers by volume. Given the elastic moduli of the glass and epoxy as 85 GPa and 3.4 GPa, respectively, and the specific gravity of glass and epoxy is 2.5 and 1.2, respectively, the elastic moduli in GPa of the composite in the direction of the glass fibers is most nearly

(A) 27.88
(B) 59.50
(C) 60.52
(D) 85.00

HINT
The longitudinal elastic modulus of the unidirectional lamina

$$E_1 = E_f V_f + E_m V_m$$

SOLUTION
The fiber Young's modulus of the fiber is $E_f = 85$ GPa.

The matrix Young's modulus of the matrix is $E_m = 3.4$ GPa

The longitudinal elastic modulus of the unidirectional lamina

$$E_1 = E_f V_f + E_m V_m$$

where

V_f = fiber volume fraction

V_m = matrix volume fraction ($V_m = 1 - V_f$)

Then

$$E_1 = (85)(0.7) + (3.4)(0.3)$$
$$= 60.52 \text{ GPa}$$

ANSWER
(C)

CONTRIBUTOR
This question of the day was provided by the courtesy of Professor Autar Kaw of the University of South Florida from the book Fundamentals of Engineering Examination Sample Questions General Engineering.