MATERIALS SCIENCE II

FLEXURAL MODULUS OF COMPOSITES

Student:	Year:
Date:	Teacher:

Program:

a) Determination of flexural modulus of composites E_{fc}.

b) Determination of fiber volume fraction v_f.

c) Flexural test and evaluation of measured data.

Symbols:

B	[	]	Specimen thickness
W	[	]	Specimen width
L	[	]	Initial distance between supports L = (16±1)·B
F	[	]	Applied force
s	[	]	Deflection
I	[	]	Moment of inertia
E	[	]	Modulus of elasticity

Used formulas:

$$I=\frac{W\cdot B^3}{12} \qquad s=\frac{\varepsilon\cdot L^2}{6\cdot B} \qquad E_f=\frac{(F_2-F_1)\cdot L^3}{48\cdot I\cdot(s_2-s_1)} \qquad E_{fc}=E_f\cdot v_f+E_m(1-v_f)$$

Lower indices:

f = fiber

m = matrix

fc = flexure of composites

1 = nominal tensile strain $\varepsilon_{fc1} = 0.0005$

2 = nominal tensile strain $\varepsilon_{fc2} = 0.0025$

Task 1:

Composite with resin matrix (E_m = 3 GPa) was reinforced by glass fibers (specimen 1) with parallel orientation (0°) and carbon fibers (specimen 2) with perpendicular orientation (90°). From the given moduli of elasticity E_{fc}, E_m and E_f, calculate the theoretical fraction volume of fibers v_f.

Volume fraction:

$v_f =$

TABLE 1: *Measured and calculated values*

Specimen	Reinforcement	E_f [GPa]	E_{fc} [GPa]	V_f [%]
1	Glass fibers	72	44,4	
2	Carbon fibers	230	44,8	

Task 2:

Test the given specimens up to $\mathbf{s_{fc2}}$, draw the graph on mm paper (Force **F** vs deflection **s**), calculate the $\mathbf{E_{fc}}$ and evaluate the results.

TABLE 2: *Measured and calculated values*

Specimen orientation			
B [ ]			
W [ ]			
I [ ]			
L [ ]			
s_{fc1} [ ]			
s_{fc2} [ ]			
FLEXURAL TEST			
F [N]	**s [ ]**	**s [ ]**	**s [ ]**

TABLE 3: *Measured values from the graph force vs deflection*

Specimen	s_1 [ ]	s_2 [ ]	Δs [ ]	F_1 [ ]	F_2 [ ]	ΔF [ ]	E_{fc} [ ]
Weave							
Warp							
Weft							

Conclusion: