Total No. of Questions – [09]

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G.R. No.	

Paper Code: P119-154(ESE)

DECEMBER 2019 / END-SEM
F. Y. M. TECH. (DESIGN ENGINEERING) (SEMESTER - I)
COURSE NAME: MECHANICS OF COMPOSITE MATERIAL
COURSE CODE: MEPA11184B
(PATTERN 2018:R1)

Time: [3 Hour]

[Max. Marks: 50]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4 OR Q.5, Q.6 OR Q.7, Q.8 OR Q.9**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) State and explain the fiber factors and matrix factors that contribute to the Mechanical Performance of composites. **[3 marks]**

OR

b) Explain with neat sketch Compression Molding process of composite manufacturing. State its advantages, limitations and applications. **[3 marks]**

Q.2 a) Write a short note on Prepregs **[3 marks]**

OR

b) The longitudinal modulus of a glass reinforced plastic lamina is to be doubled by substituting some of the glass fibers with carbon fibers. The total fiber volume fraction remains unchanged at 0.5. Calculate volume fraction of carbon fibers. E_c= 300 GPa (c = carbon fiber), E_g= 70 GPa (g = glass fiber), E_m= 5 GPa. **[3 marks]**

Q.3) a) Define the term volume fraction and obtain the expression for volume fraction of fiber for composite laminate. **[2 marks]**

OR

b) Explain with neat sketch Representative Volume Element (RVE) **[2 marks]**

Q.4 a) State the Tsai-Wu failure criteria for 2D case and determine its coefficients. Explain various ways for finding the value of coefficient F_{12}. **[8 marks]**

b) State the expression for transformation of stress and strain. Write the relationship between elements of the reduced stiffness matrix $[Q]$ and transformed reduced stiffness matrix $[\bar{Q}]$ **[6 marks]**

OR

Q.5 a) For a Graphite/epoxy unidirectional lamina , find i) Compliance Matrix, ii) reduced stiffness matrix , and iii) Strains in the 1-2 coordinate system if the applied stresses are $\sigma_1 = 2\,MPa$, $\sigma_2 = -3\,MPa$, $\tau_{12} = 4MPa$ Given: E_1=181 GPa, E_2= 10.3 GPa, G_{12}= 7.17 GPa, $\nu 12 = 0.28$. **[8 marks]**

b) State the expression for transformation of stress and strain. Write relationship between elements of the compliance matrix $[S]$ and transformed compliance matrix $[\bar{S}]$ **[6 marks]**

Q.6) a) For antisymmetric laminates show that the terms A_{16}, A_{26}, D_{16}, D_{26} are zero **[6 marks]**

b) Explain how laminates are coded with suitable example. **[4 marks]**

c) Obtain the equations for midplane strains and midplane curvatures **[4 marks]**

OR

Q.7 a) Show that for a symmetric laminate there is no coupling between extension and bending responses. **[6 marks]**

b) What are the types of laminates given below? Mention which elements of [A], [B], [D] are zero for each of them. **[8 marks]**

(i) [±45 / ± 45] (ii) [30/-45/-30/45] (iii) $[\pm\theta]$

(iv) [0/90/0/90] (v) [0/45/90/-45] (vi) $[0/90]_s$

Q.8 Determine [A], [B] and [D] matrices for [-60/0/+60] laminate with the following lamina properties laminate. Thickness is 0.2 mm. The material properties are E_1=140GPa, E_2= 10 GPa, E_6= G_{12}=6 GPa, ν_{12} = 0.3. **[14 marks]**

OR

Q.9 Derive the strain-displacement equation for laminate using CLT approach. Obtain the expression for Force and Moment resultants related to midplane strains and curvatures. List down the steps for analyzing a laminate composite subjected to the applied forces and moments. **[14 marks]**