Dr Mohit Pant
29/11/2023

Roll No:.....

DEPARTMENT OF MECHANICAL ENGINEERING, NIT Hamirpur

End Semester Examination: B.Tech. Final Year

Branch: Mechanical Engineering | **Semester:** 7th
Course Title: Mechanics of Composite Material | **Course Code:** MED-454
Time Allowed: 3 Hours | **Maximum Marks:** 50

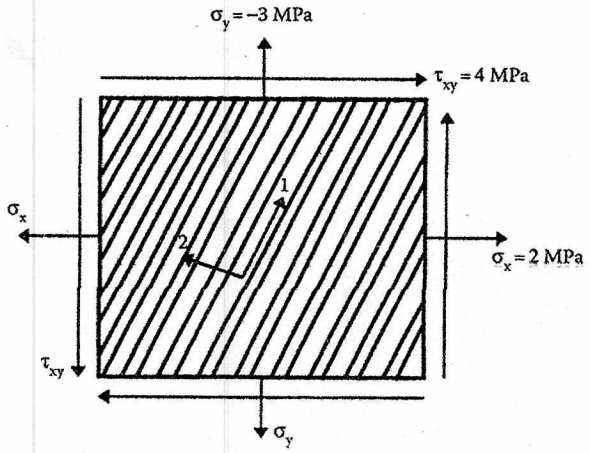
NOTE: Attempt all the questions carrying marks as indicated in brackets.

1. Discuss the concept of lamina and laminate. With a neat schematic diagram show that even with the homogenization of lamina the mechanical behavior is different from that of a homogeneous isotropic material. **(6)**

2. A displacement field in a body is given by: $u = 10^{-5}(x^2 + 6y + 7xy), w = 10^{-5}(xy + yz^2)$, $v = 10^{-5}(yz)$. Find the state of stress at $(x, y, z) = (1,2,3)$ **(6)**

3. For a two-dimensional angle lamina derive the expression for element ($\bar{Q}_{66}$ and $\bar{Q}_{11}$) of the transformed reduced stiffness matrix. **(6)**

4. For a graphite/epoxy 60^0 angle lamina as shown in figure below find the local strains in the lamina if the Engineering elastic constants of unidirectional graphite lamina are: $E_1 = 181\ GPa$, $E_2 = 10.3\ GPa$, $G_{12} = 7.17\ GPa$ V_{12}=0.28. **(10)**



5. The elastic constants of unidirectional graphite/epoxy lamina are: $E_1 = 181\ GPa$, $E_2 = 10.3\ GPa$, $G_{12} = 7.17\ GPa$, V_{12}=0.28. For a graphite/epoxy 60^0 angle lamina, find the value of engineering constants in (x-y) coordinate system. **(6)**

6. A glass epoxy lamina consists of a 70% fiber-volume fraction. Determine the mass fraction of glass and epoxy, volume of composite lamina and mass of epoxy if the mass of lamina is 4 kg. Given that density of fibre is 2500 kg/m^3 and density of matrix is 1200 kg/m^3. **(6)**

7. State the importance of invariant form of stiffness and compliance matrices for an angle lamina. State generalized Hook's law. Prove that for monoclinic material the number of independent elastic constants can be reduced to 13. **(10)**

---XXX---