INDIAN INSTITUTE OF TECHNOLOGY

Date 23.9.2002 ~~FN~~ / AN Time : 2 / ~~1~~ Hrs. Full Marks 30 No. of Students 27

Autumn / ~~Spring~~ Semester, ~~19~~ 2002 – 2003 Deptt. Aerospace Engg. Sub. No. 114001

4/5 Yr. B.Tech. (H) / ~~B.Arch. (H) / M.Sc.~~ Sub. Name Composite Materials & Structures

Instruction ANSWER ALL QUESTIONS

Q1. Describe fabrication methods, with neat sketches, for
a) a circular cylindrical FRP pipe, and
b) a solid propellant FRP motor casing. 4+4

Q.2. Determine A_{ij}, B_{ij}, D_{ij} for a $(0/90)_2$ carbon-epoxy laminate.
Assume: $h = 4$ mm, $E_{11}' = 130$ GPa, $E_{22}' = 10$ GPa
$\nu_{12}' = 0.25$, $G_{12}' = 4$ GPa 7

Q3. a) Determine hygrothermal constitutive relations for a laminate.

b) Determine $\sigma_1, \sigma_2, \sigma_6$ in a 45° lamina, when
$\sigma_1' = 600$ MPa, $\sigma_2' = 300$ MPa, $\sigma_6' = 100$ MPa
and $E_{11}' = 130$ GPa, $E_{22}' = 10$ GPa, $\Delta T = 50^\circ C$
$\nu_{12}' = 0.25$, $G_{12}' = 4$ GPa, $\Delta C = 2\%$
$\alpha_1' = -0.02 \times 10^{-6} / {}^\circ C$
$\alpha_2' = 20 \times 10^{-6} / {}^\circ C$
$\beta_1' = 150 \times 10^{-6} / \%\, \overline{C}$
$\beta_2' = 5000 \times 10^{-6} / \%\, \overline{C}$ 4+5

Q4. Write notes on Carbon fibres and Carbon–Carbon composites. 6