

Ex/Met/T/414C/2019

B.E. Metallurgical & Material Engineering Fourth Yr. 1st Semester Exam-2019
Subject: Composite Materials

Time : Three Hours

Full Marks: 100

Answer any five questions

1. 4+6+10
- i). What is composite material? Justify the definition with example.
 - ii). Write the various functions of the constituent members of a composite.
 - iii). Draw the stress-strain curve for an aligned fiber-reinforced composite and explain.
2. 12+8
- i). What parameters should be considered for designing a fiber-reinforced composite?.
 - ii). 'Almost all of the load is carried by the fibre' justify this statement with example.
3. 5x4
- i). What is the criteria of designing fibre composites with discontinuous reinforcement?
 - ii). Why is it not desirable to have very large volume fraction of fibers in composites?
 - (iii). Derive the equation for the modulus of elasticity of a fibre-reinforced composite under isostrain condition.
 - (iv). Would you expect a particle strengthened material to be stronger than a fiber strengthened material?

[Turn over

4. 8+12
- i) Draw a flow chart with schematic illustration showing classification of composites.
- ii). A continuous and aligned fiber – reinforced composite is to be produced consisting of 30 vol% aramid fibers and 70 vol% of a polycarbonate matrix. Also, the stress on the polycarbonate matrix when the aramid fibers fail is 45 Mpa. Assume that the composite has a cross-sectional area of 320 mm^2 and is subjected to a longitudinal load of 44,500 N. Given, $E_a = 131 \text{ Gpa}$, $E_p = 2.4 \text{ Gpa}$, $\sigma_a = 3600 \text{ Mpa}$, $\sigma_p = 65 \text{ Mpa}$
- (a). Compute the longitudinal tensile strength.
 (b). the longitudinal modulus of elasticity
 ©. Calculate the fiber-matrix load ratio.
 (d). Calculate the actual loads carried by both fiber and matrix phases.
 (e). Compute the magnitude of the stress on each of the fiber and matrix phases.
 (f). What strain is experienced by the composite?.
5. 14+6
- i). Derive the expression of G_{cd} & G_{cp} for an aligned short fibre reinforced composite.
- ii). Derive the equation $V_{fcritical}$ & V_{fmin} for a fibre reinforced composite.
6. 14+6
- i). Describe the various fibre making processes.
- ii). Differentiate between fibre reinforced and dispersion strengthened composites.
7. Short notes: 10x2
- i). Powder Metallurgy Technique
- ii). Compcasting process