Major Test TTL310

Dated 7.05.07

Answers must be written clearly.
Question no 1 is of 10 marks. Questions from 2-7 carry equal marks of 5. **Maximum marks: 40**

Q. No1 State if the following statements are correct. If not, make the correct statement and justify the correct/corrected statement with suitable figure wherever applicable. **10**

(a) In pultrusion process the reinforcement is nearly uniaxially oriented and the process can be used with thermoplastic resins.

(b) Filament winding process can be used for non cylindrical composite products with winding angle(α) given by: $r \times \sin \alpha = \text{Constant}$; r=local radius.
Further, this process can only be used with thermosetting resins.

(c) Radome (radio dome) is used primarily for excellent modulus/strength properties of glass/polyester composite.

(d) Metal matrix composites are primarily used for reduction of weight of the composite products.

Q. No. 2 Describe the possible method of manufacturing an efficient wind mill blade, along with selection of materials. State the criterion for your choice of the process of manufacturing and components of the composite product.

Q. No. 3 Spherical glass particles were used in stead of glass fibres to make a composite peroduct. Volume fractions of these were in the same range. The process of manufacturing was similar. What kind/s of differences would you observe between the two kinds of products?

Q. No. 4 Nearly zero thermal expansion coefficient of the composite product is needed. Select the correct combinations of the reinforcement/matrix from the following:
(1) Glass/polyester (2) Carbon & Polyethylene/epoxy(3) Carbon/epoxy
Explain the reasons for your selection. Further state whether the composite is isotropic in relation to zero thermal expansion coefficient

Q. No. 5 Why 3-d performs are preferred over laminate preparation of composite? Would it be advantageous to use hybrid reinforcement in stead of single type of reinforcement for these 3-d composites?

Q No 6 Glass/PP composites are prepared (say unidirectional). In one case the PP is allowed to crystallize fully(say around 60%). In another similar product, the product was quenched such that the level of crystallinity of PP was reduced to around 30%. What kind of differences would you observe in these two products in terms of tensile, impact and bending behaviour.

Q.no.7It is desired to produce unidirectional continuous fiber-reinforced epoxy composites, having a maximum of 50% volume of fibers. In addition, a minimum longitudinal modulus of elasticity of 50 GPa is required, as well as a minimum tensile strength of 1300 MPa. Fibres available are E-glass, carbon (PAN standard modulus), and Aramid. Which are the possible candidates and why? The epoxy has a modulus of elasticity of 3.0 GPa and a tensile strength of 75 MPa. In addition assume the following stress levels on the epoxy matrix at fiber failure; for E-glass:70 MPa; for carbon (PAN standard modulus) :30 MPa and for aramid:50 MPa.

E(Glass)=70GPa, E(Carbon)= 230 GPa, E(Aramid)= 130GPa
σ^*(Glass)=3.0, σ^*(Carbon)=4.0 GPa, σ^* (Aramid)=4.0 GPa

Useful expressions:

$Eco = E_f V_f + E_m V_m$
$Eco = 0.5\, E_f V_f + 0.5\, E_m V_m$
$Eco = (3/8).E_f V_f + (3/8).E_m V_m$