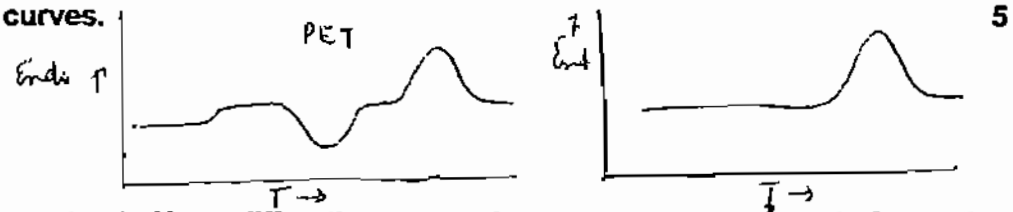
TT712L Polymer and Fibre Physics

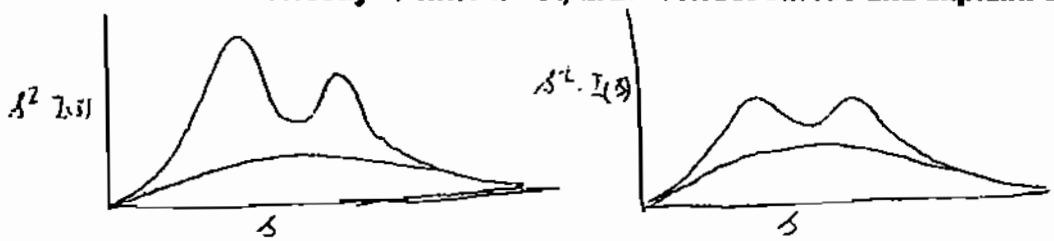
Major Test Max Marks 40 30th November2006

Note: Begin each question from a fresh page

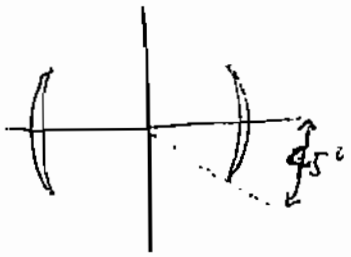
Q. No. 1 Following DSC curves are shown for as-spun polyester and as-spun nylon. Do you think these curves are correct? If not, draw correct curves. In either case explain the curves. 5



Q. No.2 Approximate X-ray diffraction curves in terms of 'I' vrs 's^2 I(s)' of two fibre samples of same polymer (say Nylon6) with crystallinity of (a) 30% (b) 60% are drawn. Are these curves correctly drawn? If not, draw correct curves and explain. 5



Q.No 3 A fibre x-ray diffraction pattern is shown below. Calculate Crystal orientation function (Fc) and amorphous orientation function (Fa) of the sample. *Make suitable assumptions, for I (ϕ).* Assume: $\Delta\eta_c = \Delta\eta_a = 0.073$ 5



Q.No. 4 Two identical filament yarns were intermingled (by, say air jet method). How would you observe the nature of intermingling? Describe the method and the principle involved in such observations. 5

Q.no. 5 (a) A sample has c=o absorption band at 1730 cm^{-1}.in infra-red spectra. Another similar sample has the band appearing at 1727 cm^{-1}. What is the origin of such differences? 5

Q.No.6 Describe briefly the following: (a) DSC gives a good estimate of crystallinities of fibre samples (b) Glass transition temperature of fibers can be estimated by Dynamic Mechanical Analysis (DMA) (c) Void fraction of fibers can be measured using density crystallinity (d) Rubber are elastic, but also have creep (e) Shift factor can be used to obtain Creep master curves (f) Crystallization temperatures of polymers is below their melting point. (5x2.5)

Useful expressions

$X_c = \int s^2 I_C(s)\, ds \,/\, \int s^2 I(s)\, ds$; $f_c = \frac{1}{2}[3\langle\cos^2\phi\rangle - 1]$; $\Delta\eta = \Delta\eta_c \chi_c f_c + \Delta\eta_a (1-\chi_c) f_a$

$\langle\cos^2\phi\rangle = \{ \int_0^{\pi/2} I(\phi)\sin\phi\cos^2\phi\, d\phi \} / \{ \int_0^{\pi/2} I(\phi)\sin\phi\, d\phi \}$