

Engineering Tripos Part IIA, 2006

Paper 3D3 Structural Materials and Design

Answers

1. (b) (i)  $M_c = 160 \text{ kNm}$   
(ii)  $M_{max} = 51.1 \text{ kNm}$
2. (a)  $305 \times 305 \times 118 \text{ UC}$  ( $\chi \sim 0.29$ ,  $P_{provided} = 1471 \text{ kN}$ )  
(b) (ii)  $Z_p(\text{required}) = 1168 \text{ cm}^3$ , possible section  $356 \times 171 \times 67 \text{ UB}$
3. (b) (i)  $M_U = 97.1 \text{ kNm}$ ,  $L/d \sim 29 \therefore \text{SLS unlikely to be satisfied}$   
(ii)  $M_U = 86.6 \text{ kNm}$
4. (a) (i)  $f_{m,d} = 6.94 \text{ MPa}$   
(b) (i)  $h = 327 \text{ mm}$ , if neutral axis is at the interface, the concrete remains in compression  
(ii)  $\kappa = 1.17 \times 10^{-6} \text{ mm}^{-1}$  (timber/concrete)  $< \kappa = 6.11 \times 10^{-6} \text{ mm}^{-1}$  (timber)  
 $\sigma_{comp} = 2.33 \text{ MPa}$  (timber/concrete),  $\sigma_{comp} = 8.98 \text{ MPa}$  (timber)

J.L. June, 2006