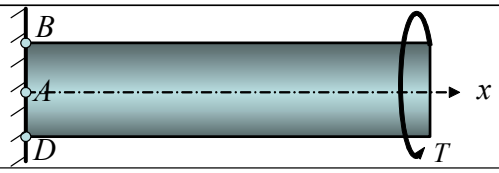
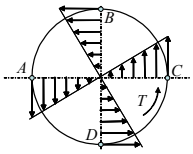
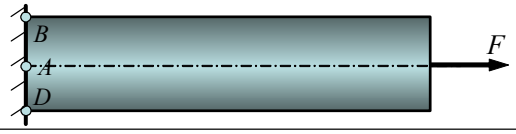
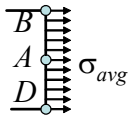
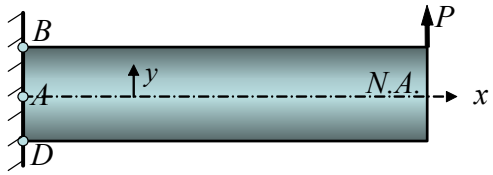
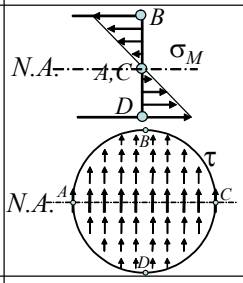
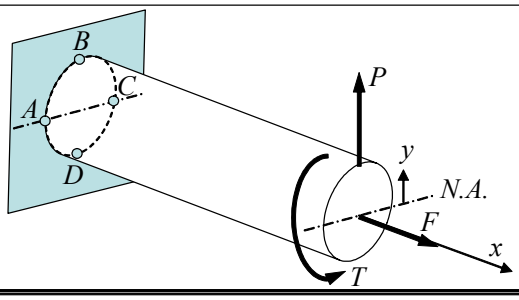
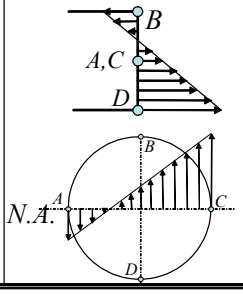
7.3 COMBINED LOADS (SI&4th: 416-427; 5th: 416-427)

In the previous chapters, we developed methods for determining the stress distribution in a member subjected to different types of load such as an axial force or a transverse shear force (Chapter 2), a torsional moment (Chapter 4), and a bending moment (Chapter 6). Most often, the cross section of a member is subjected to several of these loadings *simultaneously*. As we shall see presently, we may combine the knowledge that we have acquired in the previous chapters. As long as the relationship between stress and the loads is ***linear*** and the geometry of the member would ***not undergo significant change*** when the loads are applied, the principle of superposition can be used as shown in Chapter 6. Here we are going to discuss the situation due to tensile force F, torque T and transverse load P, as shown in Table 7.1.

Table 7.1 Superposition of individual loads

	Stresses Produced by Each Load Individually	**Stress Distributions**	**Stresses**
Torsional Load (Torque *T*)			Torsional shear stress $\tau_T = T\rho/J$
Axial Load (Force *F*)			Tensile average normal stress $\sigma_{avg}=F/A$
Bending Load (Transverse Force *P*)			Bending normal stress $\sigma_M = -My/I$ Transverse shear stress $\tau_V = VQ/It$
Combined Loads			Total normal stress $\sigma = F/A - My/I$ Total shear stress at *N.A.* $\tau = VQ/It \pm T\rho/J$