## MEE3001 Design of Machine Elements E1+TE1

### 1

The principal stresses induced at a point in a machine component made of steel 45C8 are as follows:
$\sigma_1 = 258$ MPa  $\sigma_2 = 167$ MPa  $\sigma_3 = 0$
Calculate the factor of safety by (i) The maximum normal stress theory,
 (ii) the maximum shear stress theory, and (iii) the distortion energy theory.

### 2

A solid circular shaft made of steel 20C8 subjected to an alternating torsional moment, which varies from –245 N-m to + 470 N-m. The shaft is ground and the expected reliability is 92%. Neglecting stress concentration, calculate the shaft diameter for infinite life. The factor of safety is 2.5. Use the distortion energy theory of failure.

### 3

A bar of steel has an ultimate tensile strength of Fe 620 and fully corrected endurance limit (Se) of 235 MPa. The bar is subjected to a mean bending stress of 65 MPa and a stress amplitude of 85 MPa. Superimposed on it is a mean torsional stress and torsional stress amplitude of 75 and 40 MPa respectively. Find the factor of safety.