Solutions

2.1

- Plain average $= 0.5 \times 1.5 + 0.4 \times 2.5 + 0.1 \times 6 =$ **2.35** kN.
- $P_{eq} = (\sum f_i P_i^3)^{1/3} = (0.5 \times 1.5^3 + 0.4 \times 2.5^3 + 0.1 \times 6^3)^{1/3} =$ **3.09** kN.
- Damage grows with the cube of load, so the rare 6 kN peaks count far more than their share of time.

2.2

- $T = P/\omega = 4000/(960 \times 2\pi/60) =$ **39.8** N · m.
- $W_t = 2T/d = 2 \times 39.79/0.060 =$ **1326** N.
- $W_r = W_t \tan\phi = 1326 \tan 20° =$ **483** N; $W = \sqrt{W_t^2 + W_r^2} = \sqrt{1326^2 + 483^2} =$ **1411** N.

3.1

- Moments about B: $R_A \times 180 = 1411 \times 120$, so $R_A =$ **941** N.
- $R_B = 1411 - 941 =$ **470** N (check about A: $470 \times 180 = 1411 \times 60$).
- $n = 250/95 =$ **2.63**.
- Reasonable for steady loads on a ductile part; shock loads or fatigue would need more margin or a fatigue check.

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