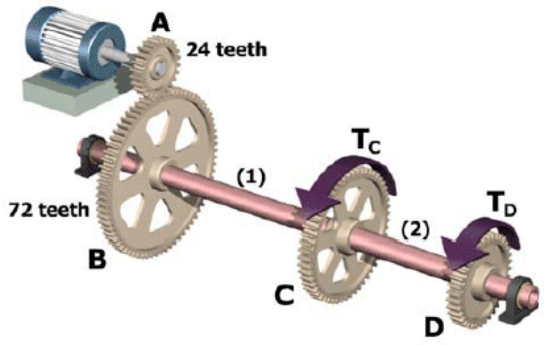
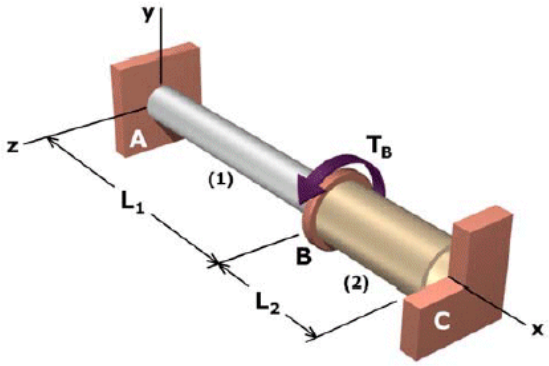
 Name: _____

A motor supplies sufficient power to the system so that gears C and D provide torques of T_C = 700 N-m and T_D = 450 N-m, respectively, to machinery in a factory. Power shaft segments (1) and (2) are hollow steel tubes with an outside diameter of D = 60 mm and an inside diameter of d = 50 mm. If the power shaft [i.e., segments (1) and (2)] rotates at 80 rpm, determine:

(a) the maximum shear stress in power shaft segments (1) and (2).
(b) the power (in kW) that must be provided by the motor.
(c) the rotation speed (in rpm) of gear A and the motor.



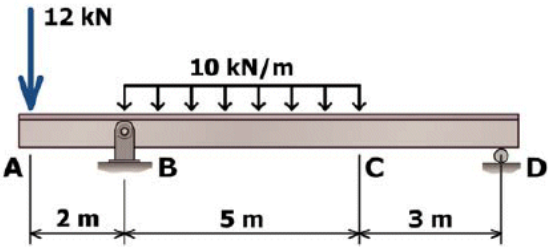
The composite shaft consists of a stainless steel tube (1) and a brass tube (2) that are connected at flange B and securely attached to rigid supports at A and C. Stainless steel tube (1) has an outside diameter of 2.25 in., a wall thickness of 0.250 in., a length of $L_1 = 40$ in., and a shear modulus of 12,500 ksi. Brass tube (2) has an outside diameter of 3.500 in., a wall thickness of 0.219 in., a length of $L_2 = 20$ in., and a shear modulus of 5,600 ksi. If a concentrated torque of $T_B = 42$ kip-in. is applied to flange B, determine the maximum shear stress magnitudes in tubes (1) and (2).

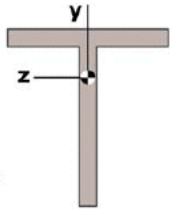


A WT305×41 standard steel shape is used to support the loads shown on the beam. The dimensions from the top and bottom of the shape to the centroidal axis are shown on the sketch of the cross section. Consider the entire 10-m length of the beam and determine:

(a) the maximum tension bending stress at any location along the beam, and

(b) the maximum compression bending stress at any location along the beam.





A glue-laminated timber beam is reinforced by carbon fiber reinforced plastic (CFRP) material bonded to its bottom surface. The cross section of the composite beam is shown. The elastic modulus of the wood is E = 12 GPa and the elastic modulus of the CFRP is 112 GPa. The simply supported beam spans 6 m and carries a concentrated load P at midspan. Determine the maximum bending stresses produced in the timber and the CFRP if P = 4 kN.