UNIVERSITY OF ARKANSAS

Closed Books and Closed Notes

Open **Excerpt** from the **Method of Model Formulas**

MEEG 3013 **Name:** ____________________

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Final Exam ( ) **ID#:** ____________________

Circle on this test sheet **your choice of correct or nearest item on the list for each of the following:**

1. A 4-ft concrete post is reinforced by four steel bars, each of 0.75-in. diameter. It is known that $E_s = 29 \times 10^6$ psi, $\alpha_s = 6.5 \times 10^{-6}$/°F, $E_c = 3.6 \times 10^6$ psi, and $\alpha_c = 5.5 \times 10^{-6}$/°F. If the tensile stress developed in the concrete due to thermal expansion is known to be 50 psi, the temperature rise ΔT is

(*a*) 74.6°F. (*b*) 76.1°F. (*c*) 77.6°F. (*d*) 79.1°F. (*e*) 80.6°F. (*f*) 82.1°F. (*g*) 83.6°F. (*h*) 85.1°F.

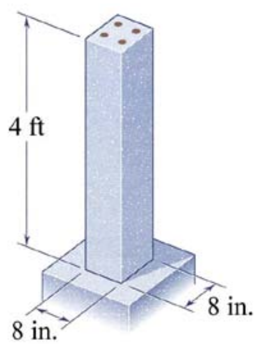

Fig. P1 and P2

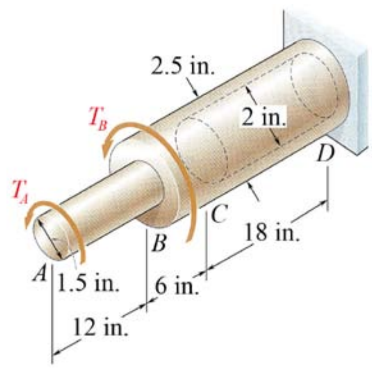

Fig. P3 and P4

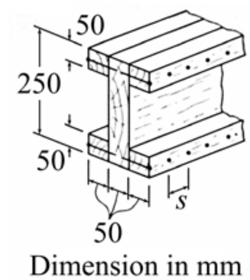

Fig. P5

2. Refer to Problem 1. The change in length δ_{post} of the post is

(*a*) 0.0228 in. (*b*) 0.0224 in. (*c*) 0.0220 in. (*d*) 0.0216 in. (*e*) 0.0212 in. (*f*) 0.0208 in. (*g*) 0.0204 in.

3. The horizontal shaft *AD* is attached to a fixed base at *D* and is subjected to the torques as shown, where $T_A = 650$ lb·ft and $T_B = 700$ lb·ft. A 2-in.-diameter hole has been drilled into portion *CD* of the shaft. If the entire shaft is made of steel for which $G = 11.2 \times 10^6$ psi, the angle of twist ϕ_A at end *A* is

(*a*) 1.235°. (*b*) 1.339°. (*c*) 1.442°. (*d*) 1.545°. (*e*) 1.649°. (*f*) 1.752°. (*g*) 1.855°. (*h*) 1.959°.

4. Refer to Problem 3. The maximum shearing stress $\tau_{\max}$ developed in portion *CD* of the shaft is

(*a*) 9.61 ksi. (*b*) 9.27 ksi. (*c*) 8.94 ksi. (*d*) 8.61 ksi. (*e*) 8.28 ksi. (*f*) 7.95 ksi. (*g*) 7.62 ksi. (*h*) 7.29 ksi.

5. The built-up wooden beam shown is subjected to a vertical shear of 5.1 kN. If the spacing of nail is s 45 mm and each nail is 90 mm long, the shearing force in each nail is

(*a*) 336 N. (*b*) 343 N. (*c*) 350 N. (*d*) 357 N. (*e*) 363 N. (*f*) 370 N. (*g*) 377 N. (*h*) 384 N.

(Cont'd on Page 2 of 2)

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Circle on this test sheet **your choice of correct or nearest item on the list for each of the following:**

6. It is desired to ascertain the range of values of θ for which the *magnitude* of the normal stress acting on the plane normal to the x' axis is $|\sigma_{x'}| \le 22$ ksi. If this range is given by $\theta_1 \le \theta \le \theta_2$, the value of θ_1 is

(a) –129.3°. (b) –132.0°. (c) –135.0°. (d) –138.5°. (e) 2.47°. (f) 5.15°. (g) 8.13°. (h) 11.60°.

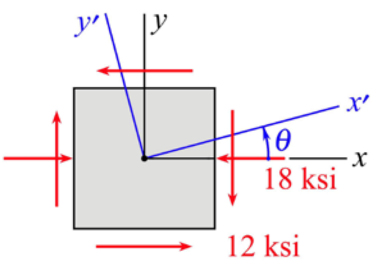

Fig. P6 and P7

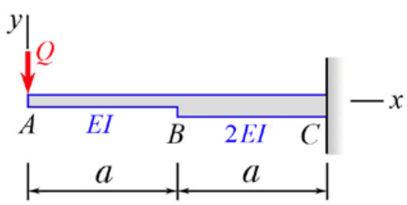

Fig. P8 and P9

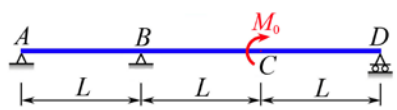

Fig. P10

7. It is desired to ascertain the range of values of θ for which the *magnitude* of the normal stress acting on the plane normal to the x' axis is $|\sigma_{x'}| \le 22$ ksi. If this range is given by $\theta_1 \le \theta \le \theta_2$, the value of θ_2 is

(a) –129.3°. (b) –132.0°. (c) –135.0°. (d) –138.5°. (e) 2.47°. (f) 5.15°. (g) 8.13°. (h) 11.60°.

8. The segments *AB* and *BC* of the stepped beam shown have flexural rigidities *EI* and 2*EI*, respectively. If $Q = 6P$, the slope θ_A at the free end *A* is

(a) $\frac{10Pa^2}{EI}$. (b) $\frac{35Pa^2}{4EI}$. (c) $\frac{15Pa^2}{2EI}$. (d) $\frac{25Pa^2}{4EI}$. (e) $\frac{5Pa^2}{EI}$. (f) $\frac{15Pa^2}{4EI}$. (g) $\frac{5Pa^2}{2EI}$. (h) $\frac{5Pa^2}{4EI}$.

9. The segments *AB* and *BC* of the stepped beam shown have flexural rigidities *EI* and 2*EI*, respectively. If $Q = 6P$, the deflection y_A at the free end *A* is

(a) $-\frac{3Pa^3}{EI}$. (b) $-\frac{9Pa^3}{2EI}$. (c) $-\frac{6Pa^3}{EI}$. (d) $-\frac{15Pa^3}{2EI}$. (e) $-\frac{9Pa^3}{EI}$. (f) $-\frac{21Pa^3}{2EI}$. (g) $-\frac{12Pa^3}{EI}$.

10. A beam is loaded and supported as shown, where $M_0 = 5PL$. The vertical reaction force $\mathbf{A}_y$ at *A* is

(a) $\frac{P}{6}\uparrow$. (b) $\frac{P}{6}\downarrow$. (c) $\frac{P}{4}\uparrow$. (d) $\frac{P}{4}\downarrow$. (e) $\frac{P}{3}\uparrow$. (f) $\frac{P}{3}\downarrow$. (g) $\frac{5P}{12}\uparrow$. (h) $\frac{5P}{12}\downarrow$. (i) $\frac{P}{2}\downarrow$.