Revisions are shown in red.

Question 26, p. 25

A turbofan engine is operating on a test stand at sea level with an ambient temperature of 80°F and an ambient pressure of 14.7 psia. Known data for the fan-compressor portion are shown in the figure. The input power (hp) required to drive the combined fan-compressor is most nearly:

- A. 19,400
- B. 25,100
- C. 87,100
- D. 112,000

Question 28, p. 27

A turbofan engine is operating on a test stand at sea level with an ambient temperature of 80°F and an ambient pressure of 14.7 psia. Known data for the fan-compressor portion are shown in the figure. The input power (hp) required to drive the combined fan-compressor is most nearly:

- A. 19,400
- B. 25,100
- C. 87,100
- D. 112,000

Question 32, p. 28

A centrifugal pump is sized to deliver 200 gpm of liquid with a specific gravity of 0.7 and a total differential head of 60 ft.
Question 43, p. 36
- A. $1.2 \times 10^6$
- B. $1.0 \times 10^6$
- C. $1.0 \times 10^5$
- D. $8.3 \times 10^4$

Question 47, p. 37
A submarine is traveling straight and level at a speed of 34.5 mph.

Question 72, p. 51
A boiler produces 150-psia saturated steam at 20,000 lbm/hr. Additionally, a 4% bottom blowdown is directed to a flash tank for auxiliary steam purposes. The heat transfer (Btu/hr) in the heat exchanger is most nearly:

Solution 26, p. 68
The last line of the solution should be:

\[
\text{whp} = \frac{105.88 \text{ ft (50 gal/min)(0.13368 ft}^3/\text{gal)(62.4 lb/ft}^3\text{)}}{33,000 \text{ ft-lb/(min-hp)}} = 1.34 \text{ hp}
\]

THE CORRECT ANSWER IS: A
Solution 28, p. 69

Compressor:

\[
\frac{T_{2,i}}{T_1} = \left(\frac{P_2}{P_1}\right)^{(k-1)/k}
\]

\[
T_{2,i} = T_1 \left(\frac{P_2}{P_1}\right)^{(k-1)/k}
\]

For air: \( k = 1.4 \)

\[
(80°F + 460)(10)^{0.4/1.4} = 1,043^oR
\]

\[
W_{comp} = \frac{\dot{m} c_p(T_{2,i} - T_1)}{\eta}
\]

\[
c_p = 0.24 \text{ Btu/(lbm}^°\text{R)}
\]

\[
W_{comp} = \left[\left(\frac{100}{\text{sec}}\right) \left(\frac{0.24}{\text{Btu/lbm}^°\text{R}}\right) \left(1,043 - 582\right)^°\text{R}\right] \left(\frac{60}{\text{sec}}\right) \left(\frac{1}{0.85}\right) \left(\frac{\text{hp-min}}{42.44 \text{ Btu}}\right)
\]

\[
W_{comp} = 18,402 \text{ hp}
\]

Fan:

\[
T_{2,i} = (540^°\text{R})(1.3)^{0.4/1.4}
\]

\[
= 582.0^°\text{R}
\]

\[
W_{fan} = \left(\frac{400}{\text{sec}}\right) \left(\frac{0.24}{\text{Btu/lbm}^°\text{R}}\right) \left(582.0 - 540\right)^°\text{R} \left(\frac{60}{\text{sec}}\right) \left(\frac{1}{0.85}\right) \left(\frac{\text{hp-min}}{42.44 \text{ Btu}}\right)
\]

\[
W_{fan} = 6,711.78 \text{ hp}
\]

\[
W_{total} = W_{comp} + W_{fan} = 18,402 \text{ hp} + 6,712 \text{ hp} = 25,114 \text{ hp}
\]

THE CORRECT ANSWER IS: B
ERRATA for
PE Mechanical Engineering: Thermal and Fluid Systems Practice Exam
ISBN: 978-1-947801-08-0
Copyright 2019
Errata posted 11/22/2022

Solution 34, p. 71
The seventh line should read as follows:

\[ Q_T \text{ for outdoor air} = (4.5) \text{ cfm} \ (\Delta h) \text{ where cfm} = 700 \text{ and } h = h_{oa} - h_{ra}, \]
\[ = (4.5)(700)(39.4 - 30.9) = 26,775 \text{ Btu/hr} \]

Solution 47, p. 76
Stagnation pressure, \( p = \rho g (SG) h + \frac{1}{2} \rho (SG) v^2 \)

Density of water, \( \rho = 62.4 \text{ lbm/ft}^3 \)

Specific gravity, \( SG = 1.03 \)

Depth, \( h = 165 \text{ ft} \)

\[ p_1 = \rho g (SG) h \]
\[ = 62.4 \text{ lbm/ft}^3 \times \left( \frac{1}{32.174} \right) \text{ slug/lbm} \times 32.174 \text{ ft/sec}^2 \times 1.03 \times 165 \text{ ft} \]
\[ = 10,604 \text{ lbf/ft}^2 \]
\[ = 73.65 \text{ psi} \]

Velocity, \( v = 34.5 \text{ mph} \times \frac{1 \text{ hr}}{3,600 \text{ sec}} \times \frac{5,280 \text{ ft}}{1 \text{ mile}} \)
\[ = 50.6 \text{ ft/sec} \]

\[ p_2 = \frac{1}{2} \rho (SG) v^2 \]
\[ = \frac{1}{2} \times 62.4 \text{ lbm/ft}^3 \times \left( \frac{1}{32.174} \right) \text{ slug/lbm} \times 1.03 \times \left( 50.6 \text{ ft/sec} \right)^2 \]
\[ = 2,557 \text{ lbf/ft}^2 \]
\[ = 17.76 \text{ psi} \]

Stagnation pressure
\[ P = 73.65 \text{ psi} + 17.76 \text{ psi} \]
\[ = 91.41 \text{ psi} \]

THE CORRECT ANSWER IS: D
Solution 64, p. 86
The third line should read as follows:

Mass of coal/day = power × heat rate / HHV