# Machine Design PE Full Exam Errata

This product has been updated to incorporate all changes shown in the comments on the webpage and email comments as of October, 30 2018. If you have purchased this product prior to this date and wish for the latest version then please email Justin Kauwale at contact@engproguides.com.

The following changes have not been incorporated into the product as of the date above and should be noted.

*December 25, 2018: Questions 2 and 22 have been revised, see attached.*

## QUESTION 1 – BASIC ENGINEERING PRACTICE

A lubrication fluid has a dynamic viscosity of 1000 poise, a specific heat capacity of 0.6 cal/g-$^{o}$C, and a density of 0.05 oz/mL. The kinematic viscosity of the fluid, in ft$^2$/sec, is most nearly?

(A) 0.8

(B) 10.9

(C) 18.3

(D) 24.2

## QUESTION 2 – BASIC ENGINEERING PRACTICE

A new machine is installed in order to increase productivity. This new machine costs $75,000 and has an ongoing operating and maintenance cost of $500 per month. The new machine will save $2,000 per month and will have a salvage value of $10,000 after 10 years. If the interest rate is 5%, then what is the annual value of the new machine?

(A) -$9715

(B) -$9,083

(C) +$9,083

(D) +$9715

## PROBLEM 5 – BASIC ENGINEERING PRACTICE

A machined product is measured and the following shows six samples, each with 10 observations per sample.

| Sample | Mean | Range |
|---|---|---|
| 1 | 3.06 | 0.42 |
| 2 | 3.15 | 0.50 |
| 3 | 3.11 | 0.41 |
| 4 | 3.13 | 0.46 |
| 5 | 3.06 | 0.46 |
| 6 | 3.09 | 0.45 |

What are the LCL and UCL for the mean chart?

(A) $UCL = 0.45; LCL = 0.40$

(B) $UCL = 3.10; LCL = 3.01$

(C) $UCL = 3.24; LCL = 2.96$

(D) $UCL = 3.15; LCL = 3.06$

## PROBLEM 6 – BASIC ENGINEERING PRACTICE

A machined product is measured and the following shows six samples, each with 10 observations per sample.

| Sample | Mean | Range |
|---|---|---|
| 1 | 78.1 | 14.1 |
| 2 | 72.1 | 8.5 |
| 3 | 63.7 | 18.1 |
| 4 | 89.4 | 18.9 |
| 5 | 80.8 | 9.2 |
| 6 | 78.8 | 14.7 |

What are the LCL and UCL for the range chart?

(A) $UCL = 24.7; LCL = 3.1$

(B) $UCL = 13.9; LCL = 13.9$

(C) $UCL = 18.9; LCL = 8.5$

(D) $UCL = 13.9; LCL = 8.5$

## QUESTION 21 – MATERIAL PROPERTIES

Which bolt material is least likely to suffer galvanic corrosion when used on a copper flange exposed to seawater? Copper has an anodic index of -0.35 V.

(A) Hot Dip Galvanized Steel, -1.20 V

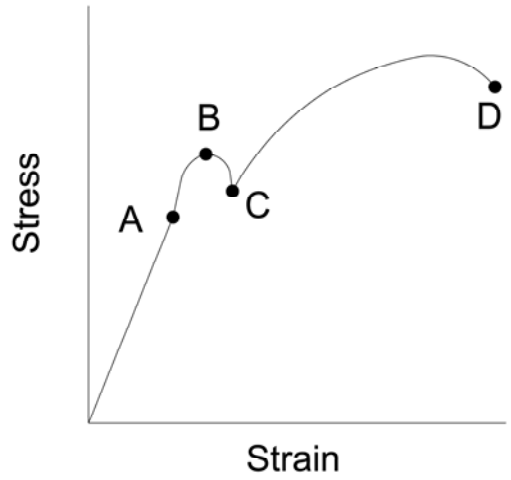
(B) Aluminum, -0.95 V

(C) 316 Stainless Steel, -0.05V

(D) Brass, -0.40 V

## QUESTION 22 – MATERIAL PROPERTIES

The following image is a stress strain diagram for a steel material.




Select the statement that is most true.

(A) As stress is increased beyond point A, the material is inelastic

(B) From point B to point C, the material is elastic.

(C) The ultimate tensile stress point is in between points B and C.

(D) Point D is referred to as the breaking point.

## PROBLEM 27 – MATERIAL PROPERTIES

A metal rod shall be constructed of a material with strength of 40,000 psi and a Young's modulus of 30 x $10^6$ psi. The rod shall be used in a design tensile load of 2,000 lbf. The rod needs to have a length of 24 in. What diameter is required to achieve an elongation of 0.01 in?

(A) 0.45 in

(B) 0.70 in

(C) 1.05 in

(D) 2.15 in

## PROBLEM 28 – STRENGTH OF MATERIALS

Four new springs are planned to equally support a piece of mechanical equipment. Each spring has 4 active coils, a free length of 2", a spring constant of 15 lb/in and a wire diameter of 0.0850 in. What is the maximum weight that the springs can hold at full compression? The ends of the coil are grounded and squared.

(A) 25 lbs

(B) 50 lbs

(C) 100 lbs

(D) 125 lbs

## QUESTION 45 – MECHANICAL COMPONENTS

A clutch is used to accelerate a pulley from 0 RPM to 800 RPM in 5 seconds. Calculate the required torque? The pulley is a solid disc shape of 10" radius and length 6". The pulley weighs 10 lbs.

(A) 2 lbf-ft

(B) 20 lbf-ft

(C) 40 lbf-ft

(D) 70 lbf-ft

## QUESTION 46 – MECHANICAL COMPONENTS

A pneumatic system is served by a compressor and a cylindrical compressed air tank. The tank is 6' long and has an outer diameter of 10". The system operates at a pressure of 500 psig. The thickness of the tank is 2". What is the hoop stress at the outer surface of the tank? Assume no external stress, the tank is classified as a thick wall and the tank is located at sea level.

(A) 500 psi

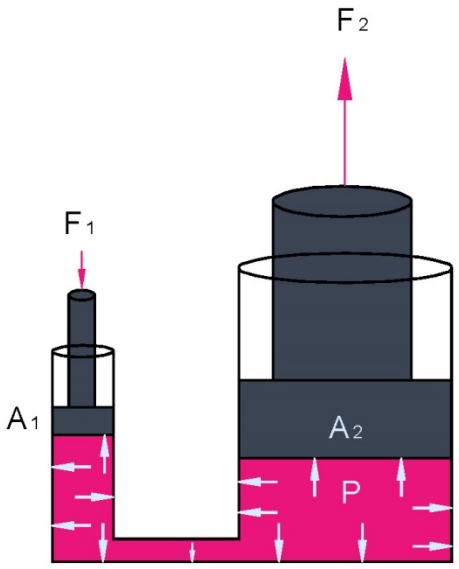
(B) 563 psi

(C) 750 psi

(D) 1,063 psi

## QUESTION 47 – MECHANICAL COMPONENTS

A master cylinder compresses the hydraulic fluid to a pressure of 80 psi. Cylinder 2 in the diagram below has a diameter of 6" and Cylinder 1 has a diameter of 1". What is the ratio of Force 2 to Force 1.




(A) 36

(B) 6

(C) 4

(D) 1/6

## QUESTION 48 – MECHANICAL COMPONENTS

Background: A 10 BHP motor operates for 4000 hours in the year. The motor is 85% efficient and the power factor is 0.85. Energy cost is $0.25 per kilowatt-hour.

Problem: How much does it cost to operate the motor in one year?

(A) $5,222

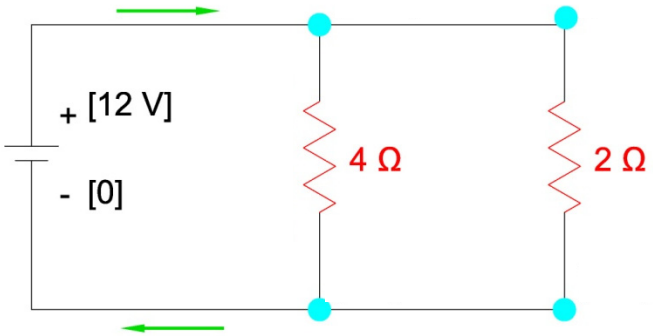
(B) $9,014

(C) $10,320

(D) $13,699

## QUESTION 51 - MECHANICAL COMPONENTS

What is the total current in the circuit below?




(A) 3 amps

(B) 6 amps

(C) 9 amps

(D) 12 amps

## QUESTION 52 - MECHANICAL COMPONENTS

A shaft is rotating at 680 RPM and has a diameter of 8 inches, a length of 2 feet. The shaft is made of a material with a modulus of elasticity of $30 \times 10^6$ psi. The shaft is placed in a bushing with a clearance of .01 inches. The dynamic viscosity of the lubricant is $1.5 \times 10^{-6}$ lb-s/in$^2$. The bearing pressure is 200 psi. What is the Sommerfeld number?

Hint: The Sommerfeld equation is located on page 165, disguised as the coefficient of friction equation without the $2\pi^2$

(A) 0.014

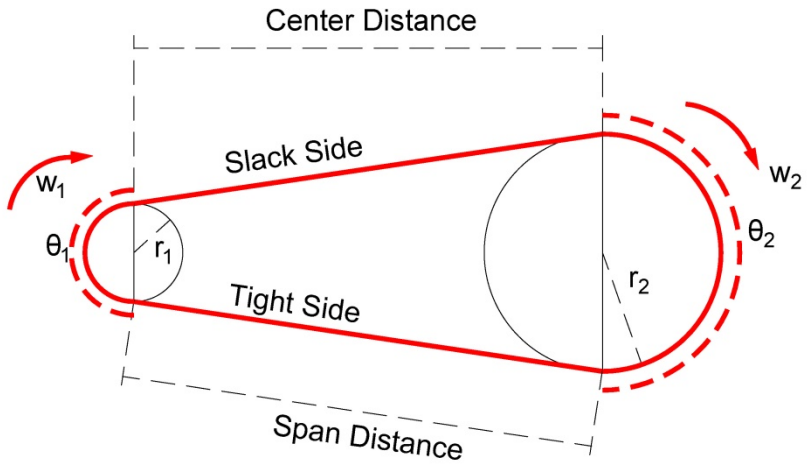
(B) 0.099

(C) 0.140

(D) 0.327

## QUESTION 57 – MECHANICAL COMPONENTS

A driven pulley has a diameter of 15 inches. The angle of wrap on the pulley is 105 degrees. Assume a flat belt drive with a coefficient of friction of 0.15. What is the tension in the belt on the tight side? The torque on the pulley is 150 lb-in.




(A) 44 lbs

(B) 63 lbs

(C) 83 lbs

(D) 109 lbs

## QUESTION 58 – MECHANICAL COMPONENTS

A V-belt drive must transmit 5 HP and maintain a belt speed of 2 ft/sec. The maximum tightness in the belt is 2,225 lbs. The coefficient of friction of the belt is 0.25, the groove angle is 30 degrees. What is the required angle of wrap? The grooved belt equation adds a sine factor to the flat belt equation.

$$\frac{T_{tight}}{T_{slack}} = e^{\frac{\mu}{sin\beta}*\theta}; \ \beta = \frac{1}{2} groove\ angle$$

(A) 57 degrees

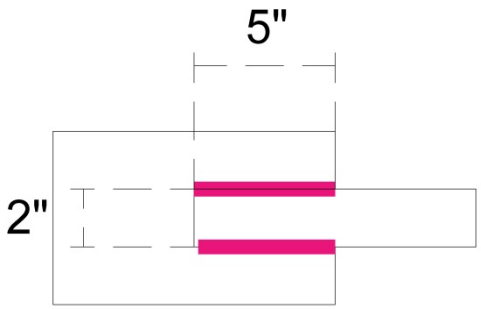
(B) 90 degrees

(C) 110 degrees

(D) 135 degrees

## QUESTION 63 – JOINTS & FASTENERS

What is the second polar moment of area of the welds in magenta? Assume a leg weld size of ¾".




(A) $3.8\ in^4$

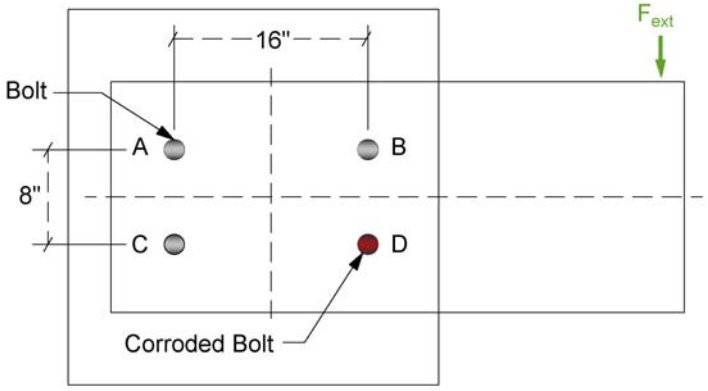
(B) $9.7\ in^4$

(C) $16.4\ in^4$

(D) $20.1\ in^4$

## QUESTION 64 – JOINTS & FASTENERS

Four ¾" diameter, 6" long bolts are configured as shown in the image below. A 10,000 lb external force is applied at the point shown. Bolt D has rusted to the point of failure and has been removed. Which bolt will experience the most stress?




(A) Bolt A

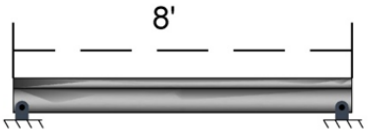
(B) Bolt B

(C) Bolt C

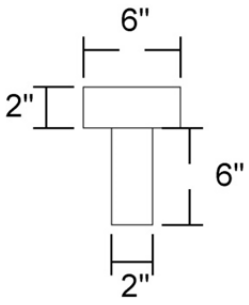
(D) Bolt C and B

## QUESTION 68 – JOINTS & FASTENERS

A point force of 1,000 lbs is applied at the center of the built-up beam. The beam is constructed of (2) 2” x 6” beams as shown in the cross section. An adhesive is used to join the two beams together. Assume the moment of inertia is equal to 136 $in^4$. What is the maximum shear stress in the adhesive?




Side View




Cross Section

(A) 11 psi

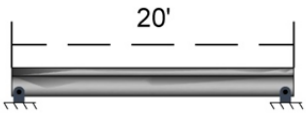
(B) 22 psi

(C) 44 psi

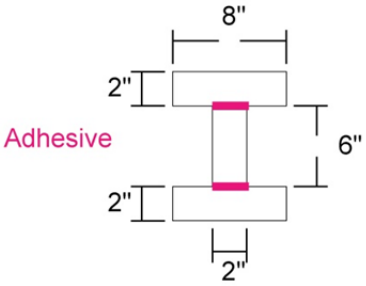
(D) 66 psi

## QUESTION 69 – JOINTS & FASTENERS

What is the shear flow in the adhesive? Assume this built up beam is subject to a distributed load of 100 lbs/ft.




Side View




Cross Section

(A) 115 lbs/in

(B) 275 lbs/in

(C) 415 lbs/in

(D) 820 lbs/in

# SOLUTION 2 – BASIC ENGINEERING PRACTICE

A new machine is installed in order to increase productivity. This new machine costs $75,000 and has an ongoing operating and maintenance cost of $500 per month. The new machine will save $2,000 per month and will have a salvage value of $10,000 after 10 years. If the interest rate is 5%, then what is the annual value of the new machine?

(A) -$9715

(B) -$9,083

**(C) +$9,083**

(D) +$9715

This problem involves finding the total annual value. First, convert all your terms to an annual value.

Initial Cost [Negative value = money lost at the beginning of the lifetime]

$$First\ navigate\ to\ your\ engineering\ economics\ tables, 5\%$$

$$Convert\ Present\ value\ (P) to\ Annual\ value\ (A)$$

$$A = P * (\frac{A}{P}, 5\%, 10)$$

$$A = -\$75{,}000 * 0.12950$$

$$A_{initial} = -\$9{,}712.50$$

Salvage Value, Positive value is equal to money gained at the end of the lifetime

$$Convert\ Future\ value\ (F) to\ Annual\ value\ (A)$$

$$A = F * (\frac{A}{F}, 5\%, 10)$$

$$A = \$10{,}000 * 0.07950$$

$$A_{salvage} = \$795$$

Operating & Maintenance Cost, negative value is equal to money lost.

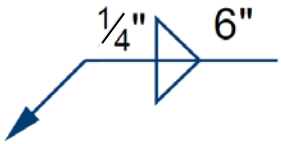
$$A_{O\&M} = \frac{-\$500}{month} * 12\ months = -\$6{,}000\ per\ year$$

Savings, positive value is equal to money gained.

$$A_{savings} = \frac{\$2{,}000}{month} * 12\ months = \$24{,}000\ per\ year$$

## SOLUTION 3 – BASIC ENGINEERING PRACTICE

Which of the following statements, best describes the below weld symbol?




(A) A ¼” fillet weld, 6” long, on the arrow side of the joint.

(B) A ¼” fillet weld, 6 times, on the arrow side of the joint.

(C) A 6” fillet weld, 1/4” long, on the arrow and other side of the joint.

(D) A ¼” fillet weld, 6” long, on the arrow and other side of the joint.

The correct answer is **(D) A ¼” fillet weld, 6” long, on the arrow and other side of the joint.**

**The weld size should be shown to the left of the symbol.**

**The weld length should be shown to the right of the symbol.**

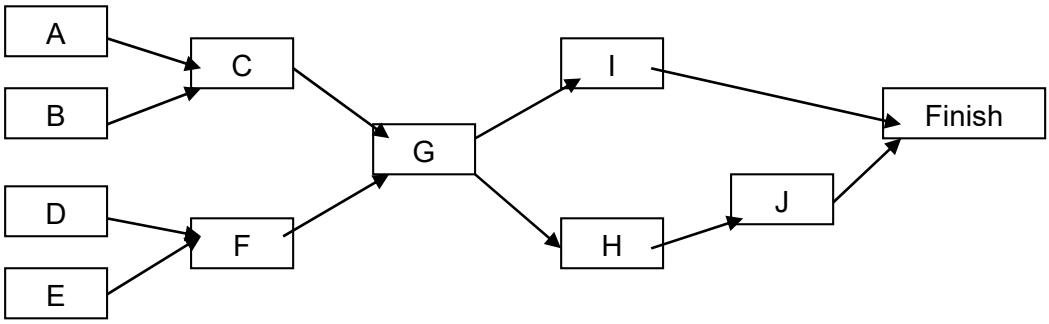
| | | |
|---|---|---|
| Finish | 0 | I & J |

(A) 17 minutes

(B) 18 minutes

(C) 19 minutes

**(D) 20 minutes**




A->C->G->I-> 17 minutes

A->C->G->H->J-> 18 minutes

B->C->G->I-> 14 minutes

B->C->G->H->J-> 15 minutes

D->F->G->I-> 18 minutes

D->F->G->H-> J -> 19 minutes

E->F->G->I-> 19 minutes

E->F->G->H-> J -> 20 minutes

The critical path is most nearly, **(D) 20 minutes**.

## SOLUTION 5 – BASIC ENGINEERING PRACTICE

A machined product is measured and the following shows six samples, each with 10 observations per sample.

| Sample | Mean | Range |
|---|---|---|

| | | |
|---|---|---|
| 1 | 3.06 | 0.42 |
| 2 | 3.15 | 0.50 |
| 3 | 3.11 | 0.41 |
| 4 | 3.13 | 0.46 |
| 5 | 3.06 | 0.46 |
| 6 | 3.09 | 0.45 |

What are the LCL and UCL for the mean chart?

(A) $UCL = 0.45; LCL = 0.40$

(B) $UCL = 3.10; LCL = 3.01$

(C) $UCL = 3.24; LCL = 2.96$

(D) $UCL = 3.15; LCL = 3.06$

The first step is to find $\bar{\bar{X}}$.

$$\bar{\bar{X}} = 3.10$$

Next find, $\bar{R}$

$$\bar{R} = 0.45$$

Now use the control chart constants table and find the variable A2 for sample size 10.

| n | A2 |
|---|---|
| 10 | 0.31 |

$$UCL = \bar{\bar{X}} + A_2 * \bar{R}; LCL = \bar{\bar{X}} - A_2 * \bar{R}$$

$$UCL = 3.10 + 0.31 * 0.45; LCL = 3.10 - 0.31 * 0.45$$

$$UCL = 3.24; LCL = 2.96$$

The correct answer is most nearly, **(C) $\boldsymbol{UCL = 3.24; LCL = 2.96}$**

## SOLUTION 6 – BASIC ENGINEERING PRACTICE

A machined product is measured and the following shows six samples, each with 10 observations per sample.

| Sample | Mean | Range |
|---|---|---|
| 1 | 78.1 | 14.1 |
| 2 | 72.1 | 8.5 |

| | | |
|---|---|---|
| 3 | 63.7 | 18.1 |
| 4 | 89.4 | 18.9 |
| 5 | 80.8 | 9.2 |
| 6 | 78.8 | 14.7 |

What are the LCL and UCL for the range chart?

**(A)** $\boldsymbol{UCL = 24.7; LCL = 3.1}$

(B) $UCL = 13.9; LCL = 13.9$

(C) $UCL = 18.9; LCL = 8.5$

(D) $UCL = 13.9; LCL = 8.5$

First find, $\bar{R}$

$$\bar{R} = 13.9$$

Next, use the following equations to find UCL and LCL.

$$LCL = D_3 * \bar{R} = 13.9 * 0.22 = 3.1$$

$$UCL = D_4 * \bar{R} = 13.9 * 1.78 = 24.7$$

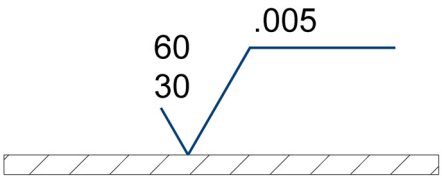
Use the charts to find the control chart variables.

| n | D3 | D4 |
|---|---|---|
| 10 | 0.22 | 1.78 |

The correct answer is most nearly, **(A)** $\boldsymbol{UCL = 24.7; LCL = 3.1}$.

## SOLUTION 7 – BASIC ENGINEERING PRACTICE

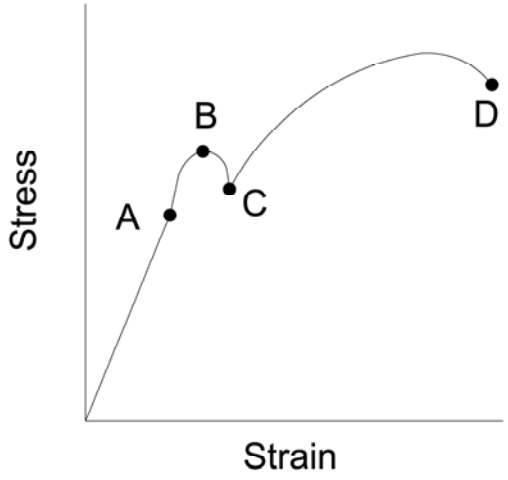
Which of the following statements is most true about the below diagram? Assume the units are metric.




(A) The average roughness is 30 micrometers.

# SOLUTION 22 – MATERIAL PROPERTIES

The following image is a stress strain diagram for a steel material.




Select the statement that is most true.

(A) As stress is increased beyond point A, the material is inelastic

(B) From point B to point C, the material is elastic.

(C) The ultimate tensile stress point is in between points B and C.

**(D) Point D is referred to as the breaking point.**

(B) 0.70 in

(C) 1.05 in

(D) 2.15 in

First, calculate the stress required to achieve this elongation.

$$\sigma = \varepsilon E$$

$$\sigma = \frac{0.01\ in}{24\ in} * 30\ x\ 10^6 psi$$

$$\sigma = 12{,}500\ psi$$

Next, use the stress equation to solve for the diameter of the rod.

$$\sigma = \frac{F}{A}$$

$$12{,}500\ psi = \frac{2{,}000\ lbf}{\frac{1}{4}\pi D^2}$$

$$D = 0.45\ in$$

The correct answer is most nearly, **(A) 0.45 in**.

## SOLUTION 28 – STRENGTH OF MATERIALS

Four new springs are planned to equally support a piece of mechanical equipment. Each spring has 4 active coils, a free length of 2", a spring constant of 15 lb/in and a wire diameter of 0.0850 in. What is the maximum weight that the springs can hold at full compression? The ends of the coil are grounded and squared.

(A) 25 lbs

(B) 50 lbs

**(C) 100 lbs**

(D) 125 lbs

The maximum weight or force that the spring can hold is characterized by the equation below:

$$F = k * (L_{free} - L_{solid})$$

$$L_{free} = 2"$$

$$L_{solid} = (6 \text{ coils}) * (0.0850\ in) = 0.51"$$

$$k = 15\frac{lb}{in}$$

$$F = 15\frac{lb}{in} * (2\text{-}0.51) = 22.4\ lbs$$

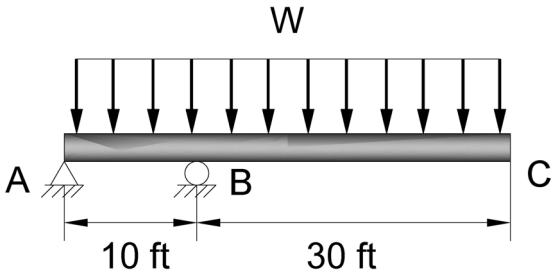
But we have four springs that can each hold 24.9 lbs, the total weight supported is as follows.

$$F_{total} = 4 * 22.4 = 89\ lbs$$

The answer is most nearly **(C) 100 lbs.**

## SOLUTION 29 – STRENGTH OF MATERIALS

A beam with a uniform rectangular cross section is subject to the loading shown below. The rectangular cross section has a length of 6" and a base of 2". The maximum moment is 500 lb-ft. What is the maximum bending stress in this beam?




(A) 45 psi

**(B) 500 psi**

(C) 1,510 psi

(D) 2,040 psi

The maximum bending stress is found through the equation shown below.

$$\sigma_{max} = \frac{Mc}{I}$$

First you need to find the second moment of area of the cross section and the distance c, which is the greatest distance from the centroid to the surface of the beam.

**(A) 2.0 lbf-ft**

(B) 20 lbf-ft

(C) 40 lbf-ft

(D) 70 lbf-ft

The torque required can be found by multiplying the mass second moment of area by the acceleration.

$$I = m\frac{1}{2}r^2$$

$$I = 10\ lbs\frac{1}{2}(10\ in)^2$$

$$I = 500\ lbs - in^2$$

The acceleration should be in terms of rev/s$^2$.

$$\alpha = \left(800\frac{rev}{min} - 0\frac{rev}{min}\right) * \frac{1\ m}{60\ s} * \left(\frac{1}{5\ s}\right) = 2.67\frac{rev}{s^2}$$

Now plug into the torque equation.

$$T = I\alpha$$

$$T = 500\ lbs - in^2 * 2.67\frac{rev}{s^2}$$

Add in the conversion factors to convert revolutions to radians and to convert lbs to lbf and inches to feet.

$$T = \frac{(500\ lbs - in^2 * 2.67\frac{rev}{s^2} * \frac{2\pi}{1\ rev})}{32.2\frac{ft}{s^2} * \frac{12\ in}{1\ ft}} * \frac{1\ ft}{12\ in}$$

$$T = 1.8\ lbf - ft$$

The correct answer is most nearly, **(A) 2.0 lbf-ft.**

## SOLUTION 46 – MECHANICAL COMPONENTS

A pneumatic system is served by a compressor and a cylindrical compressed air tank. The tank is 6' long and has an outer diameter of 10". The system operates at a pressure of 500 psig.

# SOLUTION 58 – MECHANICAL COMPONENTS

A V-belt drive must transmit 5 HP and maintain a belt speed of 2 ft/sec. The maximum tightness in the belt is 2,225 lbs. The coefficient of friction of the belt is 0.25, the groove angle is 30 degrees. What is the required angle of wrap?

**(A) 57 degrees**

(B) 90 degrees

(C) 110 degrees

(D) 135 degrees

First, use the horsepower equation to solve for the difference between the tight and slack side.

$$Power\ (HP) = \frac{(T_{tight} - T_{slack}) * v}{550}$$

$$5\ HP = \frac{(T_{tight} - T_{slack}) * 2ft/sec}{550}$$

$$T_{tight} - T_{slack} = 1{,}375\ lbs$$

But you know the maximum tension is 2,225. Thus the slack tension can be found.

$$T_{slack} = 850\ lbs$$

Now use the angle of wrap equation, but for V-belts.

$$\beta = groove\ angle\ \div 2 = 15\ degrees$$

$$\frac{T_{tight}}{T_{slack}} = e^{\frac{\mu}{sin\beta} * \theta}$$

$$\frac{2{,}225\ lbs}{850\ lbs} = e^{\frac{\mu}{sin\beta} * \theta}$$

$$\ln\left(\frac{2{,}225\ lbs}{850\ lbs}\right) = \frac{\mu}{sin\beta} * \theta$$

$$0.963 = \frac{0.25}{\sin(15\ degrees)} * \theta$$

Remember theta is in radians and needs to be converted to degrees.

$$\theta = 57.1\ degrees$$

The correct answer is most nearly, **(A) 57 degrees.**

**Table 5e. 16–Thread Series, 16–UN and 16–UNR—Basic Dimensions**

| Sizes | | Basic Major Dia., $D$ | Basic Pitch Dia.,[a] $D_2$ | Minor Diameter | | Lead Angle λ at Basic P.D. | | Area of Minor Dia. at $D-2h_b$ | Tensile Stress Area[b] |
|---|---|---|---|---|---|---|---|---|---|
| Primary | Secondary | | | Ext. Thds.,[c] $d_3$ (Ref.) | Int. Thds.,[d] $D_1$ | | | | |
| Inches | Inches | Inches | Inches | Inches | Inches | Deg. | Min. | Sq. In. | Sq. In. |
| 3/8 | | **0.3750** | **0.3344** | **0.3005** | **0.3073** | **3** | **24** | 0.0678 | 0.0775 |

Next, calculate the stress.

$$\sigma = \frac{F\ (clamping)}{(4\ bolts) * A\ (bolt)}$$

$$\sigma = \frac{20{,}000\ lbs}{(4\ bolts) * (0.0775\ in^2)} = 64{,}516\ psi$$

The factor of safety is found by dividing the strength by the actual stress.

$$FS = \frac{\sigma_{strength}}{\sigma_{actual}} = \frac{70{,}000\ psi}{64{,}516\ psi} = 1.085$$

The correct answer is most nearly, **(B) 1.09**.

## SOLUTION 66 – JOINTS & FASTENERS

A bolt is tightened to a stress of 80 kpsi and the bolt is subject to an alternating stress of 10 kpsi. The endurance strength of the bolt is 25 kpsi and the ultimate strength is 200 kpsi. What is the Goodman fatigue factor of safety?

(A) 0.6

(B) 1.0

**(C) 1.3**

(D) 2.5

The fatigue factor of safety is found by dividing the endurance strength by the Goodman equivalent stress. The equation for the Goodman equivalent stress is below.

$$\sigma_{eq} = \sigma_a + \left(\frac{S_e}{S_{ut}}\right)\sigma_m$$

$$\sigma_m = preload = 80\ kpsi;\ \ \sigma_A = 10\ kpsi$$

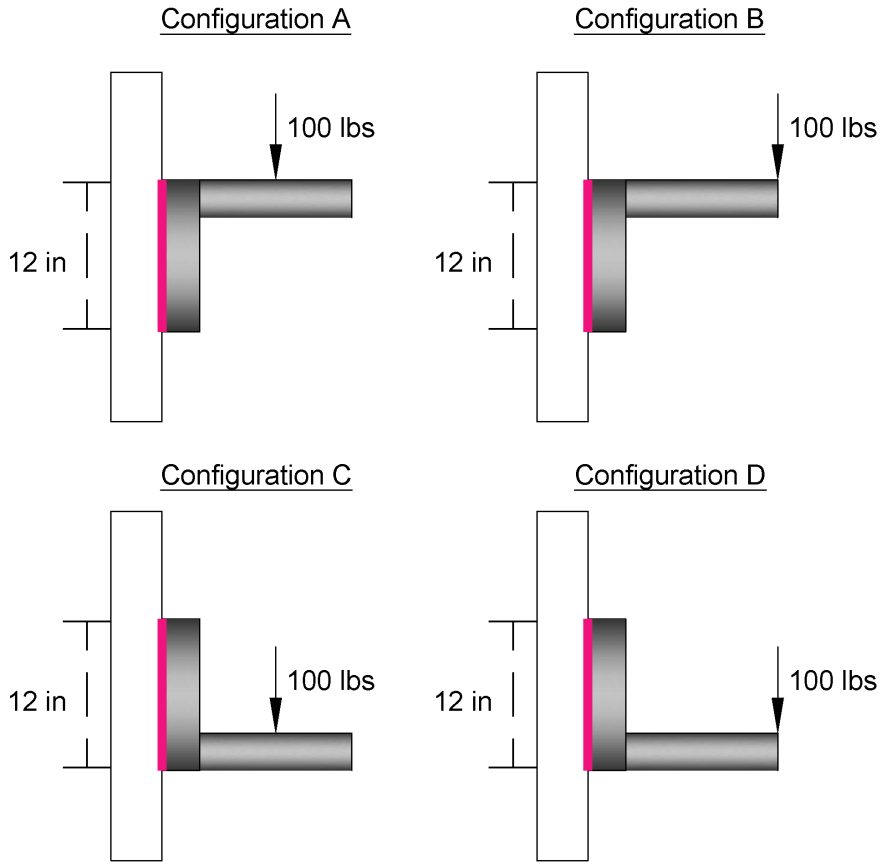
$$\sigma_{eq} = 10 + \left(\frac{25}{200}\right)80 = 20$$

$$FS = \frac{S_e}{\sigma_{eq}} = \frac{25}{25} = 1.25$$

The correct answer is most nearly, **(C) 1.3**

## SOLUTION 67 – JOINTS & FASTENERS

Which of the following configurations incurs the largest peel stress?




(A) Configuration A

**(B) Configuration B**

(C) Configuration C

(C) Configuration C

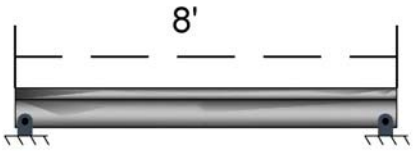
(D) Configuration D

The correct answer is most nearly, **(B) Configuration B.**

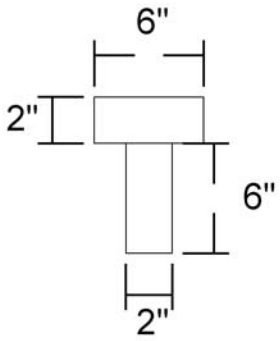
Configurations C and D cause the least peel stress. Configuration A causes less torque than configuration B, which means that the peel stress is less in configuration A.

## SOLUTION 68 – JOINTS & FASTENERS

A point force of 1,000 lbs is applied at the center of the built-up beam. The beam is constructed of (2) 2" x 6" beams as shown in the cross section. An adhesive is used to join the two beams together. Assume the moment of inertia is equal to 136 $in^4$. What is the maximum shear stress in the adhesive?




Side View




Cross Section

(A) 11 psi

(B) 22 psi

(C) 44 psi

**(D) 66 psi**

The point force will cause a shear force between the two beams. This shear force is equal to the shear stress in the beam. The maximum shear stress for this beam can be found in the beam diagrams in Section 3.0 Engineering Science and Mechanics.

$$V = \frac{P}{2} = \frac{1{,}000}{2} lbs = 500\ lbs$$

The first moment of area is found by taking the area above the shear plane (adhesive) and multiplying this value from the neutral axis to the centroid of the above area.

$$Q_z = (2\ in) * (6\ in * 2\ in) = 24\ in^3$$

The shear stress in the adhesive is found through the below equation.

$$\tau = \frac{V_y[lbs] * Q_x[in^3]}{I_x[in^4] * t\ [in]}$$

$$V_y = shear\ force; t = thickness\ (in) = 2in$$

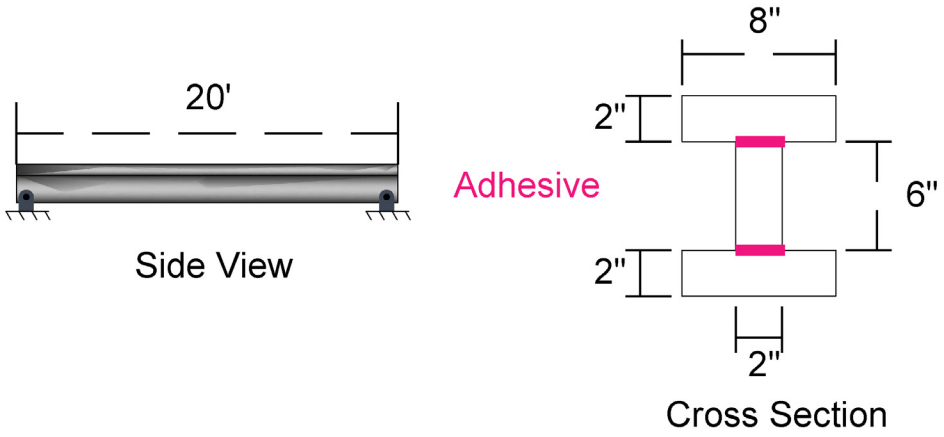
$$Q_z = first\ moment\ of\ area; I_z = second\ moment\ of\ area\ about\ z - axis$$

$$\tau = \frac{500\ lbs * 24\ in^3}{136\ in^4 * 2\ in} = 44.1\ psi$$

The correct answer is most nearly, **(C) 44 psi.**

## SOLUTION 69 – JOINTS & FASTENERS

What is the shear flow in the adhesive? Assume this built up beam is subject to a distributed load of 100 lbs/ft.




(A) 115 lbs/in

(B) 275 lbs/in

(C) 415 lbs/in

(D) 820 lbs/in

The total shear force is equal to 100 lbs/ft*8ft.