IBONG TIRIRIT (MDSP 7)

A line shaft is 2 15/16 in a diameter and will transmit 50 hp when turning at 200 rpm at constant rate. This shaft furnishes the power to 10 machines each requiring 5 hp to operate. Each of the 10 pulleys is keyed to the shaft by standard flat key. If the width and thickness of the key are ¾ and ½ respectively, find the length of the key based on shear considering that the allowable shear stress for commercial shafting is 6000 psi.

Answer: L = 0.238 in

The torque to overcome frictional and other resistances of a turbine is 317 N-m and maybe considered as constant for all speeds. The mass of the rotating parts is 1.59 tons and the radius of gyration is 686 mm, if the steam is cut-off when the turbine is running free of load at 1920 rpm, find the time it will take to come to rest.
A. 474.5 s
B. 500.81 s
C. 385.72 s
D. 601.22 s

Answer: A

A line shaft is 2 15/16 in a diameter and will transmit 50 hp when turning at 200 rpm at constant rate. This shaft furnishes the power to 10 machines each requiring 5 hp to operate. Each of the 10 pulleys is keyed to the shaft by standard flat key. If the width and thickness of the key are ¾ and ½ respectively, find the length of the key based on shear considering that the allowable shear stress for commercial shafting is 12,000 psi.

Answer: L = 0.357

A cast iron pulley transmit 65.5 hp at 1750 rpm. The 1045 as-rolled shaft to which it is to be keyed is 1 ¾ in. in diameter, key material, cold drawn 1020. Compute the length (based on shear) of flat and square key needed if the 1 ¾ in. diameter has a width and thickness 3/8 and ¼ in. respectively. Note: Sy = 66 ksi (with Sys = 0.5 Sy = 33 ksi) and N = 1.5 for smooth loading.

Answer: L = 0.327 in (for flat and square keys)

A closely coiled helical spring is made of 6 mm diameter steel wire, the mean diameter of the coil is 60 mm and there are 8 coils. Taking the modulus of rigidity as 100 kN/mm^2, find the stress in the wire when carrying an axial load of 240 N.
A. 169.7 MPa
B. 184.5 MPa
C. 195.8 MPa
D. 641.7 MPa

Answer: A

A set screw is necessary to fastened a pulley to a 2 in. shaft while transmits 3 hp and rotates at 150 rpm? Find the torque on the set screw:

Answer: 105.0 ft-lb

A s et screw is necessary to fastened a pulley to a 2 in. shaft while transmits 3 hp and rotates at 150 rpm? Find the holding force if the factor of safety is 3 (for steady loading).

Answer: 3780 lb

A flywheel of mass 500 kg and radius of gyration 1.2 m is running at 300 rpm. By means of a clutch, this flywheel is suddenly connected to another flywheel, mass 2000 kg and radius of gyration 0.6 m, initially at rest. Calculate their common speed of rotation after engagement.
A. 120 rpm
B. 130 rpm
C. 140 rpm
D. 150 rpm

Answer: D

A set screw is necessary to fastened a pulley to a 2 in. shaft while transmit 3 hp and rotates at 150 rpm? What is the typical size of set screw in practice?

Answer: ½ in.

An eccentric is to be connected to a 3-in. shaft by a set screw. The center of the eccentric is 1 ¼ in. from the center of the shaft when a tensile force of 1000 lb is applied to the eccentric rod perpendicular to the line of centers. What is the holding force necessary if the factor of safety is 6?

Answer: 5000 lb

In a two ram hydraulic steering gear, the rams are 250 mm diameter, the rubber stock is 400 mm diameter and the distance from center of rudder stock to center line of rams is 800 mm. Calculate the stress in the rudder stock when the rudder is in mid-position and the hydraulic pressure is 70 bar.
A. 31.54 MPa
B. 42.76 MPa
C. 21.87 MPa
D. 16.24 MPa

Answer: C

A 12-in gear is mounted on a 2-in shaft and is held in place by a 7/16 in set screw. For a design factor of 3 what would be the tangential load that could be applied to the teeth if the holding force of a 7/16 in screw is 2500lb?

Answer: Tangential Load is 139 lb

The cylinder head of a 10 in x 18 in Freon compressor is attached by 10 stud bolts made of SAE grade 5. The cylinder pressure is 300 psi. What is the force on each bolt?

Answer: 1571 lb

The cylinder head of a 10 in x 18 in Freon compressor attached by 10 stud bolts made of SAE grade 5. The cylinder pressure is 300 psi. what size of stud bolts should be used if SAE grade 5 (1/4″ – ¾″) has the following stresses; Sp = 85 ksi, Sy = 88 ksi?

Answer: 0.2255 in^2

An air compressor is driven by a 7.5 HP electric motor with a speed of 1750 rpm with A-60 V-belts of length 61.3 in. the pitch diameter of the small sheave is 110mm and the larger sheave is 200 mm. service factor is 1.2. determine the arc of contact.
A. 173.92 deg
B. 183.56 deg

C. 169.87 deg
D. 212.65 deg

Answer: C

A pulley 610 mm in diameter transmits 40 KW at 500 rpm. The arc of contact between the belt and the pulley is 0.35 and the safe working stress of the belt is 2.1 MPa. Find the tangential force at the rim of the pulley in Newton.
A. 2406 N
B. 4321 N
C. 2505 N
D. 3321 N

Answer: C

A pulley 610 mm in diameter transmits 40 KW at 500 rpm. The arc of contact between the belt and pulley is 144 degrees, the coefficient of friction between belt and pulley is 0.35 and the safe working stress of the belt is 2.1 and the safe working stress of the belt is 2.1 MPa. What is the effective belt pull in Newton.
A. 2505 N
B. 3031 N
C. 4528 N
D. 2823 N

Answer: A

Two shafts are connected by spur gears. The pitch radii of the gears A and B are 207 mm and 842 respectively. If the shaft a makes 350 revolutions per minute and is subjected to twisting moment of 236 N.m what is the tooth pressure of the two gears?
A. 1177 N
B. 1255 N
C. 890 N
D. 878 N

Answer: A

A machinist made two 8 DP spur gear to be mounted on a center distance of 16 inches with speed ratio of 7 to 9. The number of teeth in each gear are:
A. 100 teeth and 78 teeth
B. 120 teeth and 93 teeth
C. 144 teeth and 112 teeth
D. 150 teeth and 117 teeth

Answer: C

Two helical gears transmit 500 HP at 3600 rpm. What should be the bore diameter of each gear be if the allowable stress in gear shafts is 12500 psi?
A. 1.252 in
B. 1.3275 in
C. 1.4568 in
D. 1.5276 in

Answer: D

A thin hallow sphere of radius 10” and thickness 0.1” is subjected to an internal pressure of 100 psig. The maximum normal stress on an element of the sphere is
A. 5000 psi
B. 10000 psi
C. 7070 psi
D. 14140 psi

Answer: A

A car of mass 2000 slugs accelerates in 10 seconds from rest at a constant rate to a speed of 20 ft/sec. what is the resultant force on the car due to this acceleration?
A. 1000 lbf
B. 2000 lbf
C. 3000 lbf
D. 4000 lbf

Answer: D
A man weighs himself in an elevator. When the elevator is at rest he weighs 185 lbs: when the elevator starts moving upwards, he weighs 210 lbs. how fast is the elevator accelerating, assuming constant acceleration?
A. 1 ft/sec^2
B. 2.17 ft/sec^2
C. 4.35 ft/sec^2
D. 9.81 ft/sec^2

Answer: C

A copper column of annular cross section has an outer diameter d_2 of 15 ft and is subjected to a force of 45 kips. The allowable compressive stress is 300 lb/ft^2. What should be the wall thickness?
A. 3
B. 3.52
C. 4.59
D. 5.03

Answer: C

What can the maximum load be on the column, if the cross sectional area is 144 ft^2 and the compressive stress cannot exceed 200 lb/ft^2?
A. 20 kips
B. 22 kips
C. 28.8 kips
D. 30 kips

Answer: C

A 100 in long aluminum bar is subjected to tensile stress of 25000 psi. Find the elongation ($E=10x10^6$ psi)
A. 0.025 in
B. 0.25 in
C. 0.45 in
D. 0.65 in

Answer: B

Of the following solid shaft diameters, which is the smallest that can be used for the rotox of a 6 HP motor operating at 3500 rpm, if the maximum shear stress for the shaft is 8500 psi?
A. 5/16 in
B. 3/8 in
C. ½ in
D. 1 in

Answer: C

A cone clutch has an angle of 10 degrees and a coefficient of friction of 0.42. find the axial force required if the capacity is 7.46 KW at 500 rpm. The mean diameter of the active conical section is 300mm.
A. 0.40332 kN
B. 0.3928 kN
C. 0.2453 kN
D. 0.2384 kN

Answer: B

Answer: A

A band brake is installed on a drum rotating at a 250 rpm, and a diameter of 900 mm. the angle of contact is 1.5 pi radians and one end of the brake band is fastened to a fixed pin while the other end to the brake arm 150 mm from the fixed pin. The coefficient of friction is 0.25 and the straight brake arm is 1000 mm long and is placed perpendicular to the diameter bisecting the angle of contact. Determine the net belt pull in kN applied at the kilowatts is being absorved.
A. 4.24
B. 3.90
C. 4.0
D. 3.8

Answer: A

A simple band brake has a 76 cm and fitted with a steel band 2/5 cm thick lined with a brake lining having a coefficient of friction of 0.25. the arc of contact is 245 deg. the drum is attached to a 60 cm hoisting drum that sustain a rope load of 820 kg. the operating force has a moment arm of 1.50 m and the band is attached 12 cm from the pivot point. Find a torque just required to support the load (clockwise)
A. 2413.26 N-m
B. 3492.31 N-m
C. 2453.29 N-m
D. 1894.82 N-m

Answer: A

An engine 40 kW at 1200 rpm, with a single plate clutch with two pairs of friction surfaces transmitting the power. Consider the coefficient of friction to be a 0.30 and mean diameter of disc to be 200 mm, determine the axial force required to engine the clutch and transmit the power.
A. 4.832 kN
B. 5.305 kN
C. 3.693 kN
D. 6.922 kN

Answer: B

The collar of the capstan has an outside diameter of 8 in and an inside diameter of 6 in the total load supports is 2000 lb. if the coefficient of friction is 0.1 what is the collar friction torque.
A. 705 in-lb
B. 802 in-lb
C. 1012 in-lb
D. 972 in-lb

Answer: A

A disc clutch has a 6 pairs of containing friction surfaces. The frictional radius is 2-in and the coefficient of friction is 0.3. An axial force of 100 lb acts on the clutch. The shaft speed is 400 rpm. How much horsepower can be the clutch transmit?
A. 2.28 hp
B. 3.12 hp
C. 5.2 hp
D. 4.51 hp

Answer: A

A simple beam, 48 in long, with a static load of 6000 lbs at the center is made of C1020 structural steel. Based on the ultimate strength with Su = 65 ksi and factor of safety based on ultimate atrenght = 4 (for C1020), determine the dimensions of the rectangular cross-section for h = 2b.
A. b = 1 7/8 and h = 3 3/4
B. b = 1 3/8 and h = 3 1/4
C. b = 2 7/8 and h = 4 3/4
D. b = 1 3/8 and h = 2 3/4

Answer: A

A 15/16 – in wide key has a depth of 5/8 in. it is 12 in long and is to be used on a 200 hp. 1160 rpm, squirrel-cage induction motor. The shaft diameter is 3 7/8 in. the maximum running torque is 200% of the full-load torque. Determine the maximum direct shearing stress on the shaft considering the effect of the keyway.
A. 5990 psi
B. 2990 psi
C. 7290 psi
D. 9920 psi

Answer: B

A hallow bronze tube has an outer diameter of 2 in and an inner diameter of 1 ½ and is 12 in long. A crank 15 in long is keyed to one end and the other end is held rigidly. The modulus of rigidity is 10000000 psi. what force must be applied to the end of the crank to produce a torsional shear of 5000 psi?
A. 835 lbs
B. 853 lbs
C. 358 lbs
D. 583 lbs

Answer: C

An occupant moves toward the center of a merry go round at 6 m/s. if the merry go round rotates at 6rpm. Compute the acceleration component of the occupant normal to the radius
A. 6.79
B. 8.29
C. 7.54
D. 3.77

Answer: D

Find the number of active coils of a No. 8 wire Helical Spring index of 6, steady load with spring rate of 42.5 lb/in. maximum allowable stress is 60 ksi.
A. 25
B. 28
C. 29
D. 22

Answer: A

What type of brass that is used mostly for jewelry and articles to be gold-plated with the same ductility as copper but of greater strength?
A. Gilding Brass
B. Accessories Brass
C. Cartridge Brass
D. Red Brass

Answer: A

Which of the following is the Zinc alloys in the Aluminum Alloy Designations by ASTM?
A. Ax4xxx
B. Ax3xxx
C. Ax7XXX
D. Ax8XXX

Answer: C

Ackenman steering gear is made up of
A. Sliding and rotary pairs
B. Turning pairs
C. Rolling pairs
D. Rolling and sliding pairs

Answer: B

A motor car takes a bend of certain radius hand direction when moving at some speed if engine rotates in a clockwise direction when viewed from front, then because of centrifugal force
A. Reaction on outside wheels is increased and on inside wheels decreased
B. Reaction on inside wheels is increased and on outside wheels decreased
C. Reaction on rear wheels is increased and on front wheels decreased
D. Reaction on rear wheels is decreased and on front wheels increased

Answer: A

The notch angle of the izod impact test specimen is
A. 20°
B. 10°
C. 30°
D. 45°

Answer: D

In Vicker’s hardness testing, the pyramid indentor apex is
A. 40°
B. 161°
C. 136°
D. 122°

Answer: A

An elevator having a floor area of $18m^2$ has a minimum capacity of _____ persons
A. 4
B. 2
C. 6
D. 8

Answer: B

Find the maximum load in kgs of an elevator having a net inside platform area of $10m^2$
A. 5738 kgs
B. 5436 kgs
C. 1866.5 kgs
D. 1567.4 kgs

Answer: A

Find the maximum load in kgs of an elevator having a net inside platform area of $4m^2$
A. 5738 kgs
B. 5436 kgs
C. 1866.5 kgs
D. 1567.4 kgs

Answer: C

What should be net platform area of an elevator design to carry a maximum rated load of 13600 kg?
A. 21.42 m^2
B. 18.45 m^2
C. 30.42 m^2
D. 25.25 m^2

Answer: A

If there are 860 person occupying the building other than the first floor, then how many elevators are required?
A. 6
B. 8
C. 4
D. 10

Answer: C

The stiffness of a spring is 88 N/mm of axial compression. Find the Joules of work to increase the compression from 50 mm to 80 mm.
A. 201.2
B. 171.6
C. 150.4
D. 230.5

Answer: B

Find the Joules of work to pull a roller of mass 50 kg a distance of 8 m up a gradient inclined at 6 degrees to the horizontal neglecting resistances.
A. 340
B. 245
C. 410
D. 520

Answer: C

Manufactured from aluminum oxide have the same expected life as carbide tools but can operate at speeds from two to three times higher. They operate below 1100C.
A. Sintered carbides
B. Diamonds
C. Ceramic tools
D. Cast nonferrous

Answer: C

A plain carbon steel with approximately 0.9 to 1.3% carbon, which has been hardened and tempered.
A. Carbon tool steel
B. High-Speed steel
C. Cast nonferrous
D. Diamond

Answer: A

Carbon tool steel can be given a good edge, but is restricted to use below
A. 400 to 600 F
B. 700 to 800 F
C. 300 to 400 F
D. 800 to 1000 F

Answer: A

Which of the following contains tungsten or chromium and retains its hardness up to approximately 1100 F, a property known as red hardness
A. Ceramic tools
B. High speed steel
C. Diamonds
D. Carbon tool steel

Answer: B

Cast nonferrous tools are brittle but can be used up to approximately
A. 1700 F
B. 2000 F
C. 2200 F
D. 600 F

Answer: A

Produced through powder metallurgy from nonferrous metals
A. Diamonds
B. Ceramic tools
C. Cast nonferrous
D. Sintered Carbides

Answer: D

Sintered carbide operate at cutting speeds how many times as fast as HSS tools
A. 2 to 5
B. 5 to 7
C. thrice
D. twice

Answer: A

An engine is designed to develop 10kW of power at a mean speed of 1000 rev/min. Find the moment of inertia, in kg-m^2, of a suitable flywheel, assuming a speed variation of ± 1.5% of the mean speed and an energy fluctuation equal to 0.9 of the work done per revolution.
A. 1.612 kg-m^2
B. 1.566 kg-m^2
C. 2.014 kg-m^2
D. 2.333 kg-m^2

Answer: A

In a set of rope pulley blocks which has 3 pulleys in the top block and 2 in the bottom, an effort of 300 N is required to lift a load of 1.26 kN. Find the velocity ratio.
A. 3
B. 4
C. 2
D. 5
Answer: D
There are four pulleys in each block of a set of rope pulley blocks. If the efficiency is 70% when lifting a load of 2.8 kN, what is the effort applied?
A. 300N
B. 200N
C. 400N
D. 500N

Answer: D

The efficiency of a set of chain driven differential pulley blocks is 35% when lifting a load of 1.89kN. If the large and small pulleys of the compound sheave have 27 teeth respectively, find the effort required to lift this load.
A. 300N
B. 200N
C. 400N
D. 500N

Answer: A

The diameter of the small pulley of a set of differential pulley blocks is 130 mm. When lifting a load of 560 N, the effort required is 50 N and the efficiency is 40%. Find the diameter of the large pulley.
A. 170 mm
B. 140 mm
C. 160 mm
D. 150 mm

Answer: B

The pitch of the thread of a screw-jack is 8 mm and the effective length of the toggle-bar is 380 mm. If when lifting a load of 20kN, the work lost in overcoming friction is 70%, find the effort applied at the end of the toggle.
A. 223.4 N
B. 155.4 N
C. 334.3 N
D. 345.3 N

Answer: A

Find the number of teeth in the worm-wheel of a worm driven screw jack to give a velocity ratio of 550 if the worm is single threaded, the screw has pitch of 16 mm and the effort wheel is 100 mm diameter.
A. 26
B. 30
C. 28
D. 24

Answer: C

A carbide milling cutter 250 mm in diameter is used to cut a block mild steel with a plain cutter. The block is 500 mm long. If the feed is 0.50 mm/rev and depth of cut is 1.2 mm. determine the time required to take one cut. The over travel is 16 mm. the cutting speed is 80 m/min.
A. 8.45 min
B. 7.45 min
C. 9.45 min
D. 10.45 min

Answer: D

The feed of an 8 tooth face mill cutter is 0.325 mm per tooth at 200 rpm. The material cut is 300 BHN steel. If the depth of cut is 3 mm and width is 100 mm, calculate the power at the cutter.
A. 10.24 hp
B. 12.48 hp

C. 11.62 hp
D. 13.22 hp

Answer: B

Determine the power required for milling mild steel workpiece with a cutter of 80 mm diameter having 9 teeth and rotating at 120 rpm. The workpiece has a width of 60 mm. depth of cut is 4 mm and tooth load is 0.03 mm.
A. 1.2 kW
B. 2.3 kW
C. 1.9 kW
D. 2.6 kW

Answer: C

A leather belt 6 inches wide by ¼ in thick running at 4000 ft/min connects 12 in and 60 in. in diameter pulleys. The angles of contact are 270 deg. and 240 deg. for small and large pulleys respectively. Coefficient of friction on large pulley is 0.4 on small pulley 0.3. if the allowable tension is 100lb per in. determine the maximum horsepower that can be transmitted without considering centrifugal force.
A. 44 hp
B. 55 hp
C. 33 hp
D. 66 hp

Answer: B

Determine the time required to turn a brass component 50 mm diameter and 100 mm long at a cutting speed of 36 m/min. the feed is 0.4 and only one cut is taken.
A. 55 s
B. 75 s
C. 45 s
D. 65 s

Answer: D

A tool will cut for 4 hrs before it needs sharpening. Determine the time charged to one cycle if it takes 12 minutes to change the tool and tool can be sharpened 10 times before it is discarded.
A. 2.2 min
B. 3.3 min
C. 1.2 min
D. 4.4 min

Answer: C

A tool life of 80 minutes is obtained at a speed of 30 m/min and 8 minutes at 60 m/min. determine the cutting speed for 4 minute tool life.
A. 62 m/min
B. 82 m/min
C. 72 m/min
D. 52 m/min

Answer: B

Which of the following simple mechanical machine with the ability to increase an applied force?
A. Hinges
B. Lever
C. Roller
D. Spring

Answer: B

Which of the following devices that is mainly used to raise or lower an object?
A. Hoist
B. Lever
C. Spring
D. Roller

Answer: A

What is term applied to the process of separating different sizes of the same material?
A. Screening
B. Separation
C. Sieving
D. Fractioning

Answer: C

It is the process of separating a material into a specifically sized groups.
A. Centrifuging
B. Fractioning
C. Sieving
D. Screening

Answer: B

It is process in which metal is dipped in dilute acid solutions to remove dirt, grease, and oxides.
A. Pickling
B. Polishing
C. Sheradizing
D. Parkerizing

Answer: A

Which of the following mechanism is used to change the direction of an applied tensile force?
A. Gears
B. Pulleys
C. Flywheels
D. Ropes

Answer: B

What is usually the loss factor for most wire ropes and chains with 180° contact at low speeds?
A. varies from 1.03 to 1.06
B. varies 1.07 to 1.10
C. varies 1.20 to 1.50
D. varies 1.60 to 1.80

Answer: A

Which of the following is the method to determine the reactions on continuous beams?
A. two-moment equations
B. second moment equations
C. three-moment equations
D. third moment equations

Answer: C

A machine component of mass 0.77 kg moves with simple harmonic motion in a straight line and completes 175 oscillations per minute. Find the accelerating force when the component is 50 mm from mid-travel.

A. 11.65 N
B. 12.93 N
C. 10.44 N
D. 13.22 N

Answer: B

What load in Newton must be applied to 25 mm round steel bar 3.0 m long to stretch the bar 1.3 mm?
A. 42,056
B. 52,840
C. 55,016
D. 44,031

Answer: D

In LRT II project steel railroad rails of 10 m long are to be installed. If the lowest temperature considered is 20 deg C and a maximum temperature of 36 deg C is designed for, and the modulus of elasticity of steel to be 207,000 MPa. Determine the clearance between rails such that adjoining rail will just touch at maximum design temperature.
A. 2.34
B. 2.32
C. 3.41
D. 1.86

Answer: D
What pressure is required to punch a hole 3 in. diameter through a ¼ in. steel plate?
A. 45 tons
B. 20 tons
C. 30 tons
D. 40 tons

Answer: A

A steel tie rod on bridge must be made to withstand a pull of 600 lbs. find the diameter of the rod assuming a factor of safety of 5 and ultimate stress of 64,000 psi.
A. 0.705 in
B. 0.891 in
C. 0.809 in
D. 0.773 in

Answer: D

An engine parts is being tested with a load of 30000 lb. the allowable tensile stress is 10000 psi, modulus of elasticity of $40x10^6$ psi. If the original length of specimen is 42 inches with elongation not exceeding 0.0015 in, what diameter of the specimen is rejected?
A. 4.2 in
B. 3.0 in
C. 2.5 in
D. 5.17 in

Answer: D

A steel rod 75 in long with a cross sectional area of ¼ in^2 is held vertically firm at one end while a load of 3000 lb is suspended from the other end. If the rod stretches 0.025 in, find the modulus of elasticity of the steel.
A. $36x10^6$ psi
B. $11.5x10^6$ psi
C. $30x10^6$ psi
D. $27x10^6$ psi

Answer: A

In practice and theory as well, what is the allowed permissible misalignment in cylindrical and tapered roller bearings?
A. 0.005 rad
B. 0.006 rad
C. 0.001 rad
D. 0.003 rad

Answer: C

In practice and theory as well, the misalignment of spherical bearings should not exceed how many radians?
A. 0.0087 rad
B. 0.0065 rad
C. 0.0041 rad
D. 0.0043 rad

Answer: A

What term is used to described a maximum load that a bolt can withstand without acquiring a permanent set?
A. live load
B. dead load
C. proof of load
D. ultimate load

Answer: C

In bolts design, the quotient of the proof load and the tensile – stress area is called
A. proof strength
B. yield strength
C. section modulus
D. modulus of resilience

Answer: A

In bolts design, proof strength corresponds approximately how many percent of the 0.2 percent offset yield strength.
A. 85%
B. 95%
C. 90%
D. 45%

Answer: C

What type of brass that is usually to form tubing or piping to carry hot water in such application of radiators or condenser?
A. Red brass
B. Commercial brass
C. yellow brass
D. cartridge brass

Answer: A

It is in widespread use for the numbering system for cast iron by ASTM (American Society for Testing and Materials), then this system is based on which of the following?
A. Bearing strength
B. Compressive strength
C. axial strength
D. tensile strength

Answer: D

In casting, brass, bronze, steel, gray iron and aluminum are most often used materials. What is the

minimum wall thickness for of the aforementioned materials used in casting?
A. 5 mm
B. 10 mm
C. 7 mm
D. 3 mm

Answer: A

A rectangular key was used in a pulley connected to a line shaft with a power of 8 KW at a speed of 1200 rpm. If the shearing stress of the shaft and key are 30 N/mm^2 and 240 N/mm^2 respectively. What is the diameter of the shaft?
A. 22.2mm
B. 21.7mm
C. 25.8mm
D. 30.2mm

Answer A

A line shaft with a power of 150 kW at a speed of 1200 rpm, had a rectangular key used used in its pulley connection. Consider the shearing stress of the shaft to be 40 N/mm^2 and the key to be 200 N/mm^2, determine the shaft diameter.
A. 66.62mm
B. 53.31mm
C. 40.62mm
D. 44.94mm

Answer B

A cylinder having an internal diameter of 20 in and an external diameter of 36 in is subjected to an internal pressure of 10000 psi and an external pressure of 2500 psi. Determine the hoop stress at the inner surface of the cylinder.
A. 24,705.16 psi
B. 19,028.52 psi
C. 13,142.86 psi
D. 11,696.43 psi

Answer D

A thin walled cylindrical pressure vessel is subjected to internal pressure which varies from 750 kPa to 3550 kPa continuously. The diameter of the shell is 150 cm. Find the required thickness of the cylinder wall based on yield point of 480 MPa net endurance limit of 205 MPa and a factor of safety 2.5.
A. 21.2 mm
B. 22.22 mm
C. 23.83 mm
D. 20.72 mm

Answer: A

A compression ring is to be used at the junction of a conical head and shell. Determine the required area of the compression ring if the pressure is 50 psi and the stress is 13750 psi. Assume efficiency of the joint is 80%
A. 0.00715 d^2
B. 0.00482 d^2
C. 0.00721 d^2
D. 0.00682 d^2

Answer: A

A cylindrical vessel measuring (2ft x 5ft) holds a gas at 3000 psi, using stainless steel OQT 12000 determine the thickness of the plate with a design factor of 1.4 yield. Assume efficiency of welded joint as 85%
A. 0.549 in
B. 0.455 in
C. 1.2 in
D. 0.3 in

Answer: A

Which of the following is considered to be the lightest of all commercial metals and is used in aircraft industry?
A. titanium
B. chromium
C. magnesium
D. aluminum

Answer: C

Brass with 40% zinc are called ____
A. muntz metal
B. bronze
C. yellow brass
D. admiralty metal

Answer: A

How do you call a brass that contains 28% zinc, 1% tin and very excellent corrosion resistance especially in saltwater.
A. muntz metal
B. bronze
C. yellow brass
D. admiralty metal

Answer: D

A brass with 40% zinc, or same composition as muntz metal except for the addition of 0.75% tin that contributes to the corrosion resistance of this material.
A. naval brass
B. bronze
C. cartridge brass
D. admiralty

Answer: A

High pressure vessels and pipes carrying high pressure fluids develop which of the following stresses?
A. tangential stress only
B. radial stress only
C. bearing and stress only
D. both radial and tangential stress

Answer: C

For the rotating elements like flywheels and blowers, the analysis of stresses will be based similar on which of the following theory?
A. thin-walled cylinder
B. thick-walled cylinder
C. radial ball bearing
D. rotating shaft member

Answer: B

For thin-walled pressure vessels, which of the following statements is correct of the stresses?
A. Radial stresses is quite small as compared with the tangential stress
B. Radial stresses is quite bigger as compared with the tangential stress
C. Radial stresses is same as tangential stress

D. Only radial stress is present and no tangential stress

Answer: A

How do you call the ratio of lateral strain to longitudinal strain?
A. Poisson’s ratio
B. Modulus of resilience
C. Modulus of rigidity
D. Offset ratio

Answer: A

If a shaft 250 mm diameter can safely transmit 1860 kw of power when running at 125 rpm, calculate the power that can be safely transmittted by a shaft 375 mm diameter when running at 80 rpm, assuming the shafts are of similar material.
A. 4018 kw
B. 5063 kw
C. 3085 kw
D. 3567 kw

Answer: A

The pinion shaft of a double reduction geared turbine is 140 mm diameter, runs at 3000 rpm and the stress in it is 48 MN/m2. The main shaft is 445 mm diameter and runs at 90 rpm. Assuming that the same power is transmitted by both shafts, find the stress in the main shaft.
A. 50 mpa
B. 40 mpa
C. 60 mpa
D. 30 mpa

Answer: A

A torsion-meter on a tunnel shaft 360 mm diameter registers an angle of twist of 0.3 degree over a length of 2.5 m when running at 115 rpm. Taking the modulus of rigidity of the shaft material as 93 GN/m2, find the power transmitted.
A. 4.67 mw
B. 3.45 mw
C. 3.89 mw
D. 5.44 mw

Answer: C

Find the diameter of the coupling bolts to connect shafts which are to transmit 3000 kw when running at 100 rpm if 8 bolts are to be fitted on a pitch circle diameter of 610 mm and allowing stress of 38 MN/m2 in the bolts.
A. 65.74 mm
B. 62.72 mm
C. 55.44 mm
D. 52.45 mm

Answer: B

A tensile stress of 8000 psi and a shear stress of 4000 psi are induced in a brittle material whose working strength in straight tension is 10000 psi what is the maximum tensile stress?
A. 6000 psi
B. 9656 psi
C. 11400 psi
D. 10876 psi

Answer: B

A certain point in a material has the folllowing stresses; a tension of 4000 psi and a tension of 2000 psi. At another point in the same material are a tension of 8000 psi; a compression ratio of 4000 psi and a tension of 3000 psi. Determine the maximum shear stress at the two points.
A. 4300 psi and 9440 psi
B. 2400 psi and 8450 psi
C. 5300 psi and 10440 psi
D. 3300 psi and 9005 psi

Answer: C

Resilience (elastic toughness) is a measure of
A. energy per unit volume stored in a deformed material
B. total plastic strain and failure
C. strain energy per unit volume to reach the yield point
D. strain energy (work per unit volume) to cause fracture

Answer: C

Toughness is a measure of

A. the ratio of ultimate failure strain to yielding strain
B. energy per unit volume stored in a deformed material
C. strain energy per unit volume to reach the yield point
D. strain energy (work per unit volume) to cause fracture

Answer: D

Strain energy is a measure of

A. the ratio of ultimate failure strain to yielding strain
B. energy per unit volume stored in a deformed material
C. total plastic strain at failure
D. strain energy per unit volume to reach the yield point

Answer: B

All of the following are hardness test except
A. brinnel test
B. rockwell test
C. meyuer – vickers test
D. charpy test

Answer: D

Most metallic crystals form one of the following three lattice structures
A. hexagonal close-packed, simple tetragonal, or cubic
B. base-centered orthorombic, body-centered orthorombic, or rhombohedral
C. body-centered cubic, face-centered cubic, or hexagonal close-packed
D. simple tetragonal, body-centered tetragonal, or body-centered cubic

Answer: C

The planes of a crystalline lattice can be specified by
A. burger’s vectors
B. taylor-orowan dislocations
C. fick’s law
D. miller indices

Answer: D

Either the upper of the lower deviation, depending on which is closer to the basic size
A. fundamental deviaton
B. upper deviation
C. lower deviation
D. tolerance

Answer: A

Which of the following statements is false?
A. there is a considerable increase in the hardness and the strength of a cold-worked metal
B. cold-working a metal significantly reduces its ductility
C. cold-working causes a slight decrease in the density and electrical conductivity of a metal
D. cold work decrease the yield point as well as the strength and hardness of the metal

Answer: D

Which of the following statements is false?
A. hot-working can be regarded as the simultaneous combination of cold-working and annealing
B. hot-working increases the density of the metal
C. one of the primary goals of hot-working is to produce a fine-grained product
D. hot-working causes much strain hardening of the metal

Answer: D

Which of the following statements is false?
A. high-strength low alloy steels are not as strong as non alloy low carbon steels
B. small amounts of copper increase the tensile strength of steels
C. small amounts of silicon 1 steel have little influence on toughness or fabricability
D. additions of small amounts of silicon to steel can cause a marked decreased in yield strength of the steel

Answer: D

A round billet made of 70-30 brass with extrusion constant of 35000 psi is extruded at a temperature of 675 C. The billet diameter is 5 in. And the diameter of the extrusion is 2 in. Calculate the extrusion force required.
A. 6.6 MN
B. 5.5 MN
C. 7.7 MN
D. 4.4 MN

Answer: B
Determine the machining time to drill a hole of 20 mm diameter in a workpiece 25 mm thick by a drill at a cutting speed of 30 m/min with a feed of 0.2 mm/rev.
A. 17.6 s
B. 14.5 s
C. 19.5 s
D. 22.9 s

Answer: C

A weight of 160 lbs falls from a height of 2.5 ft to the center of a horizontal platform mounted on four helical springs. At impact each spring deflects 3 in. Calculate the wire diameter if the maximum design stress is 60,000 psi and spring index of 5.
A. 0.5 in
B. 0.8 in
C. 0.57 in
D. 0.88 in

Answer: A

A cantilever spring is composed of six graduated leaves each 2 in. Wide and 3/8 in thick. Determine the deflection if loaded with 1600 lbs at the tip. Length of springs is 27 in.
A. 8
B. 12
C. 10
D. 6

Answer: C

A 5 ton load is supported by a ½ in by 1 ½ in rectangular wire coil spring with 6 effective coils, 3 in outside diameter.
A. 1.24 in
B. 1.37 in
C. 2.34 in
D. 2.75 in

Answer: B

A load of 10,000 lb is to be raised by a short jack. The scew has a n outside diameter of 2 ½ in and am ACME single thread of two turns per in, if the coefficient of friction is 0.2 determine the torque required to raise the load.
A. 600 in-lb
B. 400 in-lb
C. 800 in-lb
D. 500 in-lb

Answer: C
Taylor’s equation relates cutting speed v and tool life T for particular combination of tool and workpiece, VT^n = constant. This equation is also known as
A. flank wear
B. crater wear
C. nose failure
D. tool life

Answer: D

After any cutting or standard grinding operation, the surface of a workplace will consist of
A. smear metal
B. superfinishing
C. ultrafinishing
D. centerless ginding

Answer: A

A method that does not require clamping, chucking or holding roun workpieces.
A. centerless grinding
B. chemical millling
C. laser machining
D. ultrafinishing

Answer: A

Uses high energy electrical discharges to shape electrically conducting workpiece
A. electrochemical machining
B. electrical discharge machining
C. electrochemical grinding
D. ultrasonic grinding

Answer: B

For common brass tools, wear ratios for the tool and workpiece vary between
A. 4:1
B. 10:1
C. 20:1
D. 8:1

Answer: C

For expensive tool materials, wear ratios for the tool and workpiece vary between
A. 4:1
B. 10:1
C. 20:1
D. 8:1

Answer: A

Removes heat by electrolysis in a high current deplation operation
A. electrochemical machining
B. electrospark machining
C. electronic erosion
D. electrical discharge machining

Answer: A

Also known as electrolytic grinding
A. laser grinding
B. ultranic grinding
C. electrochemical grinding
D. chemical milling

Answer: C

Determine the width of the leaves of a six-leaf steel cantilever spring 13 in. Long to carry a load of 375 lb with a deflection of 1 ¼ in. The maximum stress in this spring is limited to 50,000 psi.
A. 2.01 in.
B. 2.54 in.
C. 1.93 in.
D. 1.54 in

Answer: C

A coupling consisting of two circular plates welded to the ends of two shafts is to be designed using 2.54 cm diameter bolts to connect one plate to the other. The bolts are to be located at a distance of 0.1524 m from the axes of the shafts. If the coupling is to transmit 4026.8 kw at a shaft speed of 1200 rpm, how many bolts should be used in the coupling if the allowable shear stress for the bolts is 103.43 Mpa?
A. two
B. three
C. four
D. five

Answer: C
A hollow steel shaft 2.54 m long is to be designed to transmit a torque of 33,900 kJ. The shear modulus of elasticity, G = 82,740 Gpa for steel. The total angle of twist in the length of the shaft must not exceed 6 deg. And the stress in the shaft must not exceed 110.32 Mpa. What would be the ratio of the outside diameter to inside diameter?
A. 1.92
B. 1.74
C. 1.56
D. 1.38

Answer: D

A brake shoe is pressed against the surface of a 25.4 cm diameter drum rotating at 1250 rpm with a force of 111.20 N. If the coefficient of friction between drum and cylinder is 0.21, what power is dissipated in the form of heat by the drag of the brake shoe?
A. 388.2 W
B. 394.9 W
C. 401.6 W
D. 408.8 W

Answer: A

Aluminum bolts 2 cm in diameter and 500 cm long are used to hold the head on a pressure vessel. One bolt has a sensitive extensometer attached to the body of the bolt. It measures an elongation of 0.00400 mm in a ten-cm length of the bolt when it is tightened. How much force is exerted by the bolt?
A. 8670 N
B. 8770 N
C. 8870 N
D. 8970 N

Answer: A

Two masses of 100 kg are suspended by wires that are five mm in diameter. One wire is of aluminum and the other is of steel. The wires are ten meters long. How much lower will the mass held by the aluminum wire be?
A. 4.37 mm
B. 4.87 mm
C. 5.37 mm
D. 5.87 mm

Answer: B

The helical and herringbone gear teeth cut after heat treatment should have a hardness in the range of 210/300 BHN. The pinion gear teeth hardness on the other hand, ideally/normally be at how many BHN?
A. 250/320
B. 400
C. 350/380
D. 340/350

Answer: D

As a rule the center to center distance between sprocket shoul not be less than how many times the diameter of the bigger sprocket and not less than 30 times the pitch nor more than about 50 times to pitch.
A. 1.5
B. 2.5
C. 2
D. 3

Answer: A

It is the resulting cross-sectional area of the tensile test specimen divided by the specimen original area.
A. charpy ratio
B. percentage impact
C. % elongation
D. izod ratio

Answer: C

SAE 51XXX belongs to what steel family?
A. carbon
B. manganese
C. chromium
D. nickel

Answer: C

A four bar mechanism in which one of the links can perform a full rotation relative to the other three links
A. geneva mechanism
B. crossover-position mechanism
C. triple rocker mechanism
D. grashof of mechanism

Answer: D

A grashof four bar mechanism in which the shorted link is the frame or the fixed link and the other two cranks completely rotate with their axes.
A. drag-link mechanism
B. crank-rocker mechanism
C. double-rocker mechanism
D. triple-rocker mechanism

Answer: A

Which micrometer has no anvil?
A. outside micrometer
B. screw thread micrometer
C. depth micrometer
D. digit micrometer
Answer: C

The ends of a cylindrical pressure vessel of 900 mm internal diameter are hemispherical and constructed of plates 20 mm thick. Find the stress in the hemispherical ends when the internal pressure is 28 bar (28x10^5 N/m^2).
A. 35.1 MPa
B. 25.4 MPa
C. 31.5 MPa
D. 24.5 MPa

Answer: C
The shell plates of a boiler 4.5 m diameter are 42 mm thick and the tensile strength of the material is 495 MN/m^2. The efficiency of the longitudinal seams is 85% and that of the circumferential seams 85 %. Find the working pressure allowing a factor of safety of 5.
A. 2.66 MPa
B. 1.57 MPa
C. 1.66 MPa
D. 3.14 MPa

Answer: B

A beam of regular rectangular cross-section is 64 mm broad, 100 mm deep and 1.6 m long. It is simply supported at each end and carries a concentrated load of 10 kN at its mid-length. Neglecting the weight of the beam, find the maximum stress in the material.
A. 35.7 MPa
B. 57.3 MPa
C. 53.7 MPa
D. 37.5 MPa

Answer: D

A cantilever of rectangular section is 100 mm broad by 150mm deep and carries a concentrated load of 15 kN at its free end. Neglecting the weight of the beam, find the distance from the free end where the stress at the outer fiber is 75 MN/m^2.
A. 1.875 m
B. 0.875 m
C. 2.785 m
D. 3.785 m

Answer: A

A shaft 120 mm diameter is 1.6 m long and its mass is 102 kg concentrated load of 20 kN is hung at the center of length. Find the maximum stress in the shaft.
A. 32.67 MPa
B. 44.53 MPa
C. 48.32 MPa
D. 36.45 Mpa

Answer: C

Find the twisting moment in a solid shaft 125 mm diameter when the angle of twist is 0.5 degree on a length of 1.8 m, the modulus of rigidity of the shaft material being 93 GN/m^2
A. 12.9 KNm
B. 11.4 KNm
C. 10.8 KNm
D. 13.9 KNm

Answer: C

A hollow shaft is 400 mm diameter outside and 250 mm diameter inside and transmits a torque of 480KNm. Calculate the angle of twist over a length of 7.5 m. Take G=92.5 GN/m^2
A. 1.05 deg
B. 1.66 deg
C. 2.01 deg
D. 2.55 deg

Answer: A

All of the following are crystalline point defects except
A. schottky defects
B. interstitial impurity atoms
C. screw dislocations
D. vacancies

Answer: C

A specific method of inc galvanizing in which parts are tumbled in zinc dust at high temperatures
A. sheradizing
B. polishing
C. super finishing
D. pickling

Answer: A

A hot-dip or electroplate application of tin to steel
A. tin-plating
B. organic finishes
C. metal spraying
D. lapping

Answer: A

A zinc coating applied to low carbon steel to improve corrossion resistance. The coating can be applied in a hot dip bath, by electroplating or by dry tumbling (sheradizing)
A. parkerizing
B. hard surfacing
C. honing
D. galvanizing

Answer: D

The diffusing of aluminum into a steel surface, producing an aluminum oxide that protects the steel from high-temperature corrossion.
A. electroplating
B. burnishing
C. calorizing
D. buffing

Answer: C

An electroplating-acid bath oxidation process for aluminum and magnesium. The workpiece is the anode in the electrical circuit.
A. abrasive cleaning
B. barrel finishing
C. tumbling
D. anodizing

Answer: D

Brittle materials produce discrete fragments, known as
A. chip breaker grooves
B. non-segmented chips
C. discontinuous chips
D. type-two chips

Answer: C

Which of the following terms is used to descry punch-pressed operations like forming, blanking shallow drawing and coining?
A. stamping
B. heading
C. roll treading
D. spinning

Answer: A

Which of the following is the effect of cold rolling and cold drawing in mechanical properties?
A. both have the same effect
B. cold rolling is better than cold drawing
C. cold drawing is better than cold rolling
D. both have no effect

Answer: A

Which of the following processes produce a refined grain structure and eventually increased strength and ductility of the material?
A. extrusion
B. cold working
C. forging
D. hot rolling

Answer: C

The S30200 is usually called and 18-8 stainless steel, which means 8% of what?
A. chromium
B. nickel
C. carbon
D. manganese

Answer: B

It is a supersaturated solid solution of carbon in ferrite and it is the hardest and strongest form of steel?
A. bainite
B. ferrite
C. martensite
D. lignite

Answer: C

Which of the following processes usually used to create a bar of material of a particular shape and dimensions?
A. extrusion
B. cold working
C. forging
D. hot rolling

Answer: D

The G10400 is a plain carbon steel with a carbon content of which of the following?
A. 0.37 to 0.44 %
B. 0.21 to 0.54 %
C. 0.25 to 0.57 %
D. 0.34 to 0.54 %

Answer: A

The S30200 is usually called and 18-8 stainless steel, which means 18% of what?
A. chromium
B. nickel
C. carbon
D. manganese
Answer: A

A shearing machine requires 150 kg m of energy to shear a steel sheet, and has a normal speed of 3.0 rps, slowing down to 2.8 rps during the shearing process. The flywheel of the machine has a mean diameter of 75 cm and weighs 15.5 kg/cm^3. The width of the rim is 30 cm. If the hub and arms of the flywheel account for 15% of its total weight, find the thickness of the rim in cm.
A. 0.00487 cm
B. 0.00432 cm
C. 0.00363 cm
D. 0.00482 cm
Answer: C

In a shearing machine the energy is 29,264 ft-lb, the ultimate shearing stress of the steel plate is 40,000 psi, the plate thickness is 1 inch the length of the plate which can be sheared is:
A. 7055 in
B. 10.55 in
C. 12.75 in
D. 17.56 in
Answer: D
What would be the weight of a flywheel in kg if the weight of the rim is 3 times the sum of the weight of the hub and arms. Given the outside diameter and inside diameter to be 24 in and 18 in respectively and the rim width is 4.5 in. (assume steel flywheel)
A. 140.95 kg
B. 160.95 kg
C. 200.95 kg
D. 152.95 kg

Answer: D

A cast iron flywheel with a mean diameter of 36 inches changes speed from 300 rpm to 280 while it gives up 8000 ft-lb of energy. What is the coefficient of fluctuation.
A. 0.069
B. 0.015
C. 0.082
D. 0.020

Answer: A

A sheet metal working company purchase a shearing machine from a surplus dealer without a flywheel. It is calculated that the machine will use 2380 joules of energy to shear a 1.2 mm thick sheet metal. The flywheel to be used will have a mean diameter of 91.44 cm with a width of 25.4 cm. The normal operating speed is 180 rpm and slows down to 160 rpm during the shearing process. Assuming that the arms and the hub will account for 12% of the rim weight concentrated at the mean diameter and that the material density is 0.26 lb/cu. In. Compute for the weight of the flywheel.
A. 296 kg
B. 306 kg
C. 347 kg
D. 385 kg

Answer: B

A 48 in diameter spoked steel flywheel having a 12 in wide x 10 in deep rim rotates at 200 rpm. How long a cut (in inches) can be stamped in one inch thick aluminum plate if utimate shearing strength of the aluminum is 40,000 lb/in^2. During stamping, the force exerted by the stamp varies from a maximum F lb at the point of contact to zero lb when the stamp emerges from the metal. Neglect the weight of the flywheel and spokes and use 0.28 lb/in^3 density for flywheel material.
A. 43.2 in
B. 41.1 in
C. 44.5 in
D. 35.9 in

Answer: B

A shearing machine requires 150 kg m of energy to shear a steel sheet, and has a normal speed of 3.0 rps, slowing down to 2.8 rps during the shearing process. The flywheel of the machine has a mean diameter of 75 cm and weighs 15.5 kg/cm^3. The width of the rim is 30 cm. If the hub and arms of the flywheel account for 15% of its total weight, find the thickness of the rim in cm.
A. 0.00487 cm
B. 0.00432 cm
C. 0.00363 cm
D. 0.00482 cm

Answer: C

High pressure vessels and pipes carrying high pressure fluids develop which of the following stresses?
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B. radial stress only
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B. radial stresses is quite bigger as compared with the tangential stress
C. radial stresses is same as tangential stress
D. only radial stress is present and no tangential stress

Answer: A

How do you call the ratio of lateral strain to longitudinal strain?
A. poisson’s ratio
B. modulus of resilience
C. modulus of rigidity
D. offset ratio

Answer: A

How do you call a brass that contains 28% zinc, 1% tin and very excellent corrosion resistance especially in saltwater.
A. muntz
B. bronze
C. yellow brass
D. admiralty metal

Answer: D

1. A carbide milling cutter 250 mm in diameter is used to cut a block mild steel with a plain cutter. The block is 500 mm long. If the feed is 0.50 mm/rev and depth of cut is 1.2 mm, determine the time required to take one cut. The over travel is 16 mm. the cutting speed is 80 m/min.
    a. 8.45 min
    b. 7.45 min
    c. 9.45 min
    d. 10.45 min
    Ans: D

2. The feed of an 8 tooth face mill cutter is 0.325 mm per tooth at 200 rpm. The material cut is 300 BHN steel. If the depth of cut is 3 mm and width is 100 mm, calculate the power at the cutter.
    a. 10.24 hp
    b. 12.48 hp
    c. 11.62 hp
    d. 13.22 hp
    Ans: B
3. Determine the power required for milling a mild steel work piece with a cutter of 80 mm diameter 9 teeth and rotating at 120 rpm. The work piece has a width of 60 mm. depth of cut is 4 mm and tooth load is 0.03 mm
    a. 1.2 kW
    b. 2.3 kW
    c. 1.9 kW

d. 2.6 kW
Ans: C

4. A leather belt 6 inches by ¼ in. thick running at 4000 ft/min. connects 12 in and 60 in. in diameter pulleys. The angles of contact are 270 deg. And 240 deg for small and large pulleys respectively. Coefficient of friction on large pulley is 0.4 on small pulley 0.3. if the allowable tension is 100 lb per in. determine the maximum horsepower that can be transmitted without considering centrifugal force.
   a. 44 hp
   b. 55 hp
   c. 33 hp
   d. 66 hp
   Ans: B

5. Determine the time required to turn a brass component 50 mm diameter and 100 mm long at a cutting speed of 36 m/min. the feed is 0.4 and only one cut is taken.
   a. 2.2 min
   b. 3.3 min
   c. 1.2 min
   d. 4.4 min
   Ans. C

6. A tool will cut for 4 hrs before it needs sharpening. Determine the time charged to one cycle if it takes 12 minutes to change the tool can be sharpened 10 times before it is discarded.
   a. 62 m/min
   b. 82 m/min
   c. 72 m/min
   d. 52 m/min
   Ans. B

7. Which of the following simple mechanical machine with the ability to increase an applied force?
   a. Hinges
   b. Lever
   c. Roller
   d. Spring
   Ans: B

8. Which of the following devices that is mainly used to raise or lower an object?
   a. Hoist
   b. Lever
   c. Spring
   d. Roller
   Ans: A

9. What is term applied to the process of separating different sizes of the same material?
   a. Screening
   b. Separation
   c. Sieving
   d. Screening
   Ans:C

10. It is the process of separating a material into a variety of specifically sized groups.
    a. Centrifugal
    b. Fractioning
    c. Sieving
    d. Screening
    Ans: B

11. It is process in which metal is dropped in dilute acid solutions to remove dirt, grease, and oxides.
    a. Pickling
    b. Polishing
    c. Sheradizing
    D. Pakerizing
    Ans: A

12. Which of the following mechanism is used to change the direction of an applied tensile force?
    a. Gears
    b. Pulleys
    c. Flywheels
    d. Ropes
    Ans: B

13. What is usually the lose factor for most wire ropes and chains with 180° contact at low speeds?
    A. varies from 1.03 to 1.06
    B. varies 1.07 to 1.10
    C. varies from 1.20 to 1.50
    D. varies from 1.60 to 1.80
    Ans: A

14. Which of the following is the method to determine the reactions on continuous beams?
    a. two-moment equations
    b. Second moment equations
    c. three-moment equations
    d. third moment equations
    Ans: C

15. A machine component of mass 0.77 kg moves with simple harmonic motion in a straight line and completes 175 oscillations per minute. Find the accelerating force when the component is 50 mm from mid-travel.
    a. 11.65 N
    b. 12.93 N
    c. 10.44 N
    d. 13.22 N
    Ans: B

16. What load in Newton must be applied to a 25 mm round steel bar 3.0 m long to stretch the bar 1.3 mm?
    a. 42,056
    b. 52,840
    c. 55,016
    d. 44,031
    Ans: D

17. In the LRT II project steel railroad rails of 10 meters long are to be installed. If lowest temperature considered is 20 deg. C and a maximum temperature of 36 deg C is designed for, and the modulus of elasticity of steel to be 207,000 Mpa, determine the clearance between the clearance between rails such that adjoining rail will just touch at maximum design temperature.
a. 2.34
b. 3.32
c. 3.41
d. 1.86
Ans: D

18. What pressure is required to punch a hole 3 in. diameter through a ¼ in. steel plate?
a. 45 tons
b. 20 tons

c. 30 tons
d. 40 tons
Ans: A

19. A steel tie rod on bridge must be made to withstand a pull of 6,000 lbs. find the diameter of the rod assuming a factor of safety of 5 and ultimate stress of 64,000 psi.
a. 0.705 in
b. 0.891 in
c. 0.809 in
d. 0.773 in
Ans: D

20. An engine parts is being tested with a load of 30,000 lb. the allowable tensile stress is 10,000 psi, modulus of elasticity of 40×10^{5} psi. If the original length of specimen is 42 inches with elongation not exceeding 0.0015 inch, what diameter of the specimen is required?
a. 4.2 in
b. 3.0 in
c. 2.5 in
d. 5.17 in
Ans: D

21. A steel rod 75 inches long tested with a load of 3000 lb is suspended from the other end. If the rod stretches 0.025 inches, find the modulus of elasticity of the steel.
a. 36×10^{6} psi
b. 11.5×10^{6} psi
c. 30×10^{6}psi
d. 27×10^{6} psi
Ans: A

22. Considered is 20 deg C and a maximum temperature of 30 deg C is designed for, and the modulus of elasticity of steel to be 207,000 Mpa, determine the clearance between rails such that adjoining rail will just touch at maximum design temperature.
a. 2.34
b. 2.32
c. 3.41
d. 1.86
Ans: D

23. What pressure is required to punch a hole 3 in. diameter through a ¼ in. steel plate?
a. 45 tons
b. 20 tons
c. 30 tons
d. 40 tons
Ans: A

24. In practice and theory as well, what is the allowed permissible misalignment in cylindrical and tapered roller bearings?
a. 0.005 rad
b. 0.006 rad
c. 0.001 rad
d. 0.003 rad
Ans: C

25. In practice and theory as well, the misalignment of spherical bearings should not exceed how many radians?
a. 0.0087 rad
b. 0.0065 rad
c. 0.0041 rad
d. 0.0043 rad
Ans: A

26. What term is used to describe a maximum load that a bolt can withstand without acquiring a permanent set?
a. Live load
b. Dead load
c. Proof load
d. Ultimate load
Ans: C

27. In bolts design, the quotient of the proof load and the tensile-stress area is called
a. proof strength
b. yield strength
c. section modulus
d. modulus of resilience
Ans: A

28. In bolts design, proof strength corresponds approximately how many percent of the 0.2 percent offset yield strength?
a. 85%
b. 95%
c. 90%
d. 45%
Ans: C

29. What type of brass that is usually used to form tubing or piping to carry hot water in such application of radiators or condenser?
a. Red brass
b. Commercial brass
c. Yellow brass
d. Cartridge brass
Ans: A

30. It is in widespread use for the numbering system for cast iron by ASTM (American Society for Testing and Material), then this system is based on which of the following?
a. Bearing Strength
b. Compressive Strength
c. Axial Strength
d. Tensile Strength
Ans: D

31. It casting, brass, bronze, steel, gray iron and aluminum are most often used materials. What is the minimum wall thickness for of the aforementioned materials used in casting?
a. 5mm
b. 10mm
c. 7 mm
d. 3 mm
Ans: A

32. A rectangular key was used in a pulley connected to a line shaft with a power of 8 kw at a speed pf 1200 rpm. If the shearing stress of the shaft and key are 30 N/mm^2. Respectively. What is the diameter of the shaft?
a. 22.2 mm
b. 21.7 mm
c. 25.8 mm
d. 30.2 mm
Ans.A

33. A line shaft with a power of 150 KW at a speed of 1200 rpm, had a rectangular key used in its pulley connection. Consider the shearing of stress of the shaft to be 40 N/mm^2 and the key to be 200 N/mm^2, determine the shaft diameter.
a.66.62 mm
b.53.31 mm
c.40.82mm
d.44.94 mm
Ans. B

35. A cylinder having an internal diameter of 20 in and an external diameter of 36 in is subjected to an internal pressure of 10,000 psi and an external pressure of 2,500 psi. Determine the hoop stress at the inner surface of the cylinder.
a. 24, 705.16 psi
b. 19, 028.52 psi
c. 13, 142.86 psi
d. 11, 696.43 psi
Ans. D.

36. A thin walled cylindrical pressure vessel is subjected to internal pressure which varies from 750 kPa to 3350 kPa continuously. The diameter of the shell is 150 cm. Find the required thickness of the cylinder based on yield point of 480 MPa net endurance limit of 205 MPa and a factor of safety of 2.5.
a. 21.2 mm
b. 22.21 mm
c. 23.83 mm
d. 20.72 mm
Ans. A

37. A compression ring is to be used at the junction of a conical head and shell. Determine the required area of the compression ring if the pressure is 50 psi and the stress is 13750 psi. Assume efficiency of the joint is 80%.
a. 00715 d^2
b. 0.00482 d^2
c. 0.00712 d^2
d. 0.00682 d^2
Ans. A

38. A cylindrical vessel measuring (2ft x 5 ft) holds a gas at 3,000 psi. Using stainless OQT 12000, determine the thickness of the plate with a design factor of 1.4 yield. A assume efficiency of welded joint as 85%.
a. 0.549 in
b. 0.455 in
c. 1.2 in
d. 0.3 in
Ans. A

39. Which of the following is considered to be the lightest of all commercial metals and is used in aircraft industry?
a. titanium
b. chromium
c. magnesium
d. aluminum
Ans. C

40. Brass with 40% zinc are called ___
a. muntz metal
b. bronze
c. yellow brass
d. admiralty metal
Ans. A

41. How do you call a brass that contains 28% zinc, 1 % tin and very excellent corrosion resistance especially in saltwater.
a. muntz metal
b. bronze
c. yellow brass
d. admiralty metal
Ans. D

42. A brass with 40% zinc or same composition as muntz metal expect for the addition of 0.75% tin that contributes to the corrosion resistance of this material.
a. naval brass
b. bronze
c. cartridge brass
d. admiralty metal
Ans. A

43. High pressure vessels and pipes carrying high pressure fluids develop which of the following stresses?
a. tangential stress only
b. radial stress only
c. bearing stress only
d. both radial and tangential stress
Ans. C

44. For the rotating elements like flywheels and blowers, the analysis of stresses will be based similar on which of the following theory?
a. thin-walled cylinder
b. thick- walled cylinder
c. radial ball bearing
d. rotating shaft member
Ans. B

45. For thin-walled pressure vessels, which of the following statements is correct of the stresses?
a. Radial stresses is quite small as compared with the tangential stress.
b. Radial stresses is quite bigger as compared with the tangential stress.
c. Radial stresses is same as tangential stress.
d. Only radial stress is present and no tangential stress.
Ans. A

46. How do you call the ratio of lateral strain to longitudinal strain?
a. Poission’s ratio
b. Modulus of resilience
c. Modulus of rigidity
d. Offset ratio
Ans. A

47. A sheet metal working company purchase a shearing machine from a surplus dealer without a flywheel. It is calculated that the machine will use 2380 Joules of energy to shear a 1.2 mm thick sheet metal. The flywheel to be used will have a mean diameter of 91.44 cm with a width of 25.4 cm. The normal operating speed is 180 rpm and slows down to 160 rpm during the shearing process. Assuming that the arms and the hub will account for 12 % of the rim weight concentrated at the mean diameter and that the material density is 0.26 lb/cu/ in, compute for the weight of the flywheel.
a. 296 kg
b. 306 kg
c. 347 kg
d. 385 kg
Ans. B

48. A 48 in diameter spoked steel flywheel having a 12 in wide x 10 in deep rim rotates at 200 rpm. How long a cut (in inches) can be stamped in one inch thick aluminum plate if ultimate shearing strength of the aluminum is 40,000 lb/in2. During stamping , the force exerted by the stamp varies from a maximum F lb at the point of contact to zero lb when the stamp emerges from the metal. Neglect the weight of the flywheel weight of the flywheel and spokes and use 0.28 lb/in3 density for flywheel material.
a. 43.2 in
b. 41.1 in
c. 44.5 in

d. 35.9 in
Ans. B

49. A shearing machine requires 150 kg m of energy to shear a steel sheet, and has normal speed of 3.0 rev/sec slowing down to 2.8 rev/sec during the shearing process. The flywheel account for 15% of its total weight, find the thickness of the rim in cm.
a. 0.00487 cm
b. 0.00432 cm
c. 0.00363 cm
d. 0.00482 cm
Ans. C

50. In a shearing machine the energy is 29,264 ft-lb, the ultimate shearing stress of the steel plate is 40,000 psi, the plate thickness is 1 inch the length of the plate which can be sheared is:
a. 7055 in
b. 10.55 in
c. 12.75 in
d. 17.56 in
Ans. D

51. What would be the weight of a flywheel in kg if the weight of the rim is 3 times the sum of the weight of the hub and arms. Given the outside diameter and inside diameter to be 24 in and 18 in respectively and the rim width is 4.5 in. (assume steel flywheel)
a. 140.95 kg
b. 160.95 kg
c. 200.95 kg
d. 152.95 kg
Ans. D

52. A cast iron flywheel with a mean diameter of 36 inches changes speed from 300 rpm to 280 while it gives up 8000 ft-lb of energy. What is the coefficient of fluctuation?
a. 0.069
b. 0.015
c. 0.082
d. 0.020
Ans. A

53. Which of the following processes usually used to create a bar of material of a particular shape and dimensions?
a. extrusion
b. cold working
c. forging
d. hot rolling
Ans. D

54. The G10400 is a plain carbon steel with steel with a carbon content of which of the following?
a. 0.37 to 0.44%
b. 0.21 to 0.54%
c. 0.25 to 0.57%
d. 0.34 to 0.54%
Ans. A

55. The S30200 is usually called and 18-8 stainless steel, which means 18% of what?
a. chromium
b. nickel
c. carbon
d. manganese
Ans. A

56. Which of the following terms is used to descry punch-pressed operations like forming, blanking shallow drawing and coining?
a. stamping
b. heading
c. roll treading
d. spinning
Ans. A

57. Which of the following processes produce a refined grain structure and eventually increased strength and ductility of the material?
a. Extrusion
b. Cold working
c. Forging
d. Hot rolling
Ans. C

58. The S30200 is usually called and 18-8 stainless steel, which means 8% of what?
a. Chromium
b. Nickel
c. Carbon
d. Manganese
Ans. B

59. It is a supersaturated solid solution of carbon in ferrite and it the hardest and strongest form of steel?
a. Bainite
b. Ferrite
c. Martensite
d. Lignite
Ans. C

60. An ammonia compressor is driven by a 20kW motor. The compressor and the motor RPM are 380 and 1750, respectively. The small sheave has a pitch diameter of 152.4 mm. If the bolt to be used is standard C-120 (L=122.9in.). Determine the center distance between sheaves
- 709 mm
- 865 mm
- 806 mm
- 686 mm

Ans. C

61. A safety valve spring having 9 and ½ coils has the ends squared and ground. The outside diameter of the coil is 115 mm and the wire is 13 mm. It has a free length of 203 mm. Determine the length of the wire to which this spring must be initially compressed to hold a boiler pressure of 1.38 MPa on the seat of 32 mm diameter. Modulus of rigidity is taken as $G=80GN/m^2$.
A. 172
B. 179
C. 192
D. 158

Ans. A

62. A single threaded trapezoidal metric thread has a pitch of 4 mm, and a mean diameter of 18 mm. It is used as a translation screw in conjunction with a collar having an outside diameter of 37 mm and an inside diameter of 27 mm. Find the required torque in N-m to raise a load of 400 kg if the coefficient of friction is 0.3 for both thread and collar.
A. 34.6 N-m
B. 32.6 N-m
C. 39.1 N-m
D. 38.5 N-m

Ans. B

63. Determine the diameter of the stud bolt that are required to fasten down the cylinder head of a 203 mm x 304 mm gas engine. There are ten bolts on the block. The explosion pressure is 31 kg/sq.cm and

studs are made of ordinary bolts material SAE 1020. How deep should the bolt be drilled?
A. 38.1 mm
B. 40.2 mm
C. 37.3 mm
D. 35.5 mm
Ans. A

64. A single square thread power screw is to raise a load of 70 kN. The screw has a major diameter of 36 mm and a pitch of 6 mm. The coefficient of thread friction and collar friction are 0.13 and 0.10 respectively. If the collar mean diameter is 90 mm and the screw turns at 60rpm, find the combined efficiency of screw and collar.

A. 13.438%
B. 15.530%
C. 14.526%
D. 12.526%
Ans. D

65. Find the horsepower required to drive a power screw lifting a load of 4000 lbs. A 2 and ½ inches double square thread with two threads/in is to be used. The friction radius of the collar is 2 inches and the coefficients of friction are 0.1 for the threads and 0.15 for the collar. The velocity of the nut is 10 ft/min.
A. 5.382 HP
B. 4.395 HP
C. 3.683 HP
D. 6.472 HP
Ans. B

66. A flywheel has a mean diameter of 4 ft and is required to handle 2200 ft-lb of kinetic energy. The flywheel has a width of 8in. Normal operating speed is 300 rpm and the coefficient of fluctuation is to be 0.05. Find the weight of the rim assuming that the arms and hub are equivalent is 10% of the specific weight.
A. 412 lb
B. 334 lb
C. 452.4 lb
D. 533 lb
Ans. B

67. Find the rim thickness for a cast iron flywheel with a width of 200 mm, a mean diameter of 1.2 in a normal operating speed of 300 rpm, a coefficient fluctuation of 0.05 and which is capable of hanging 3000 N-m of kinetic energy. Assume that the hub and arms represent 10% of the rim weight and the specific weight of cast iron is 7200 kg/m^3
A. 25.28 mm
B. 28.82 mm
C. 28.25 mm
D. 25.25 mm
Ans. C

68. A cast iron flywheel is rotated at a speed of 1200 rpm and having a mean rim radius of 1 foot. If the weight of the rim is 30 lbs. What is the centrifugal force? Use factor C=41.
A. 14,800 lbs
B. 70,000 lbs
C. 14 860 lbs
D. 14,760 lbs
Ans. D

69. The maximum-strain theory which apples only in elastic range of stresses are also known as _____
A. Hooke's Law
B. Saint Venant's Theory
C. Stress-strain Theory
D. Cataligno's Theory
Ans. B

70. It refers to the collision of two or more masses with initial velocities.
A. Shock
B. Impact
C. Creep
D. Load
Ans. B

71. A term used to describe sudden applied force or disturbance.
A. Shock
B. Impact
C. Creep
D. Load
Ans. A

72. A cone-disk spring is also known as _____
A. Believille Spring
B. Heavy duty spring
C. Helical spring
D. Conical spring
Ans. A

73. What is the other term used for die casting?
A. Thermosetting
B. Shell-molding
C. Metal-mold casting
D. Tangential casting
Ans. C

74. It is a cold-working process in which metal is gathered or upset.
A. Heading
B. Cold rolling
C. Spinning
D. Stamping
Ans. A

75. Which of the following is the high-leaded brass used for instrument, lock and watch parts?
A. Red brass
B. Commercial brass
C. Yellow brass
D. Engraver's brass
Ans. D

76. The rapid cooling of steel to a temperature between 400 to 800 deg F in enough time, then austenite is transformed into a materials called.
A. Bainite
B. Lignite
C. Quinite
D. Ferrite
Ans. A

77. A centrifugal pump is directly couple to a motor. The pump rating is 3,600 liters per minute against a total head of 8 meters of water. Pump efficiency is 65% at shaft speed of 550 rpm. Calculate the torsional stress induced on the 40 mm diameter motor shaft.
A. 11,193.45 kPa
B. 12,420.72 kPa
C. 10,010.85 kPa
D. 13,113.83 kPa
Ans. C

78. A 80 mm solid shaft is to be replaced with a hallow shaft of equal torsional strength. Find percentage of weight saved, if the outside of the hallow shaft is 100 mm.
A. 56.53%
B. 67.31%

C. 48.49%
D. 52.90%
Ans. D

79. A solid transmission shaft is 4.0 inches in diameter. It is desired to replace it with a hallow shaft of the same material and same torsional strength but its weight should only be half as much as the solid shaft. Find the outside diameter of the hallow shaft in millimeters.
A. 107.315 mm
B. 112.231 mm
C. 122.940 mm
D. 131.204 mm
Ans. C

80. A railroad track is laid at a temperature of 10 degree F with gaps of 0.01 feet between the ends of the rails. The rails are 33 feet long. If they are prevented from buckling, what stress will result from a temperature of 110 degree F? Coefficient of linear expansion = $6.5x10^{-6}$ per degree F.

A. 10,000 psi
B. 8,530 psi
C. 9,450 psi
D. 10409 psi
Ans. D

81. What load P which causea total deformation of 0.036 inch of a steel rack which has a cross-section area of 4 sq. inches and a length of 5 ft.
A. 55,000 lb
B. 72,000 lb
C. 60,000 lb
D. 50,000 lb
Ans. B

82. A lubrication where lubricant is introduced between surfaces which are in rolling contact such as roller gears or rolling bearings?
A. Hydrostatic lubrication
B. Hydrodynamic lubrication
C. Elastohydrodynamic lubrication
D. Solid-film lubrication
Ans. C

83. What lubrication is usually used when bearings are operating at extreme temperatures?
A. Hydrodynamic lubrication
B. Solid-film lubrication
C. Hydrostatic lubrication
D. Liquid-film lubrication
Ans. B

84. Which of the following is not a form of bearing lubrication?
A. Liquid-film lubrication
B. Hydrodynamic lubrication
C. Hydrostatic lubrication
D. Solid-film lubrication
Ans. A

85. In ASTM standard, what is the instrument used in determining viscosity?
A. Dynamic viscometer
B. Saybolt universal furol
C. Hagen-Poinsulle viscometer
D. Saybolt universe viscometer
Ans. D

86. In what country that the present theory of hydrodynamic lubrication originates from?
A. China
B. Germany
C. US
D. England
Ans. D

87. In viscosity chart, Raimond-Boyd analysis assumed that the viscosity of the lubricant is _____
A. Constant
B. Increasing
C. Decreasing
D. Vanishing
Ans. A

88. What do you call the phenomenon occurring when two touching surfaces have a high contact pressure and when these surfaces have minute relative motion?
A. Prestressing
B. Friction
C. Fretting
D. Carving
Ans. C

89. What type of bolt threaded on both ends and can be used where a through bolt impossible?
A. Coupling
B. Stud bolt
C. Carriage bolt
D. Machine bolt
Ans. B

90. What type of bolt distinguished by a short potion of the shank underneath the head being square or finned or ribbed?
A. Coupling
B. Stud bolt
C. Carriage bolt
D. Machine bolt
Ans. C

91. What is the term applied to the reciprocal of the velocity ratio?
A. Train value
B. Modular value
C. Ratio factor
D. None of these
Ans. A

92. For very slender column, what type of formula that is best applied?
A. Column formula
B. Moment formulas
C. Slenderness formulas
D. Euler formula
Ans. A

93. Which of the following is the type of failure due to unstability?
A. Buckling
B. Stability
C. Slenderness formulas
D. Euler formula
Ans. A

94. What type of spring made in the form of dished washer?
A. Air spring
B. Volute spring
C. Believille spring
D. Motor spring
Ans. C

What is the minimum number of teeth on a smaller sprocket for high speed?

A. 12
B. 21
C. 24
D. 14
Ans. B

Which of the following is the minimum number of teeth on a smaller sprocket for moderate speed?
A. 15
B. 12
C. 21
D. 17
Ans. D

What is the minimum number of teeth on a smaller sprocket for low speed?
A. 11
B. 17
C. 21
D. 12
Ans. 12

Two shaft at right angles to each other may be connected by what arrangement?
A. Half turn
B. ¾ turn
C. Quarter turn
D. One turn
Ans. C

What is the recommended initial tension of the belt?
A. 75 lb/in of width
B. 71 lb/in of width
C. 73 lb/in of width
D. 80 lb/in of width
Ans. A

What factor of safety is needed for a 2 in. diameter shaft with an ultimate strength of 50,000 psi to transmit 40,000 in-lb torque.
A. 2.25
B. 1.95
C. 2.14
D. 2.62
Ans. D

A round steel shaft transmits 373 watts at 1800 rpm. The torsional deflection is not to exceed 1 deg in a length equal to 20 diameters. Find the shaft diameter.
A. 6.53 mm
B. 8.72 mm
C. 12.84 mm
D. 18.16 mm
Ans. A

A steel shaft operates at 186 rad/s and must handle 2 kW of power. The shearing stress is not to exceed 40 MN/m^2. Calculate the minimum shaft diameter based on pure torsion.
A. 9 mm
B. 11 mm
C. 13 mm
D. 15 mm
Ans. B

A 100 mm diameter solid shaft is to be replaced with a hollow shaft equally strong (torsion) and made of the same material. The outside diameter of the hollow shaft is to 27 mm. What should be the inside diameter? The allowable shearing stress is 41.4 MPa?
A. 107.42 mm
B. 105.82 mm
C. 291.53 mm
D. 109.60 mmw
Ans. A

If the weight of 6″ diameter by 48″ long SAE 1030 shafting is 174.5 kg then what will be the weight of chromium SAE 51416 of same size?
A. 305.79 lbs
B. 426.70 lbs
C. 347.96 lbs
D. 465.89 lbs
Ans. C

A 50 inches diameter diamond saw blade is mounted on a pulley driven steel shaft, required a blade peripheral linear speed of 150 ft/sec. Motor drive is 125 hp at 1,200 rpm, with 6 inches diameter pulley. Determine the shaft rpm to attain blade peripheral speed required.
A. 716.2 rpm
B. 635.3 rpm
C. 539.10 rpm
D. 687.55 rpm
Ans. D

A steel shaft transmits 40 hp at 1400 rpm. Considering allowable shearing stress based on pure torsion to be 5000 psi, find the torsional deflection of the shaft in degrees per foot.
A. 0.392 degrees/foot
B. 0.246 degrees/foot
C. 0.541 degrees/foot
D. 0.435 degree/foot
Ans. B

The process by which high pressure is applied to a heated metal billet or blank which causes it to flow through restricted orifice.
A. Extrusion
B. Intrusion
C. Forging
D. Hot rolling
Ans. A

A tolerance where the size of a part is permitted to be either larger or smaller than the given dimension.
A. Bilateral
B. Unilateral
C. Lateral
D. None of these
Ans. A

In a pressure vessel, the ratio of minimum strength of joint to the strength of solid joint is known as
A. Efficiency
B. Performance factor
C. Joint efficiency
D. Relative strength
Ans. D

When tested in compression, ductile material usually exhibit_____ characteristics up to the yield strength as they do when tested in tension.
a. the same
b. less than
c. more than
d. approximately the same
ans. D

In pure torsion, the maximum stress is at the center of the
a. peripheral sides
b. long sides
c. medium sides
d. short sides
ans: B

The ability of a material to absorb energy within is proportional limit is known as
a. resilience
b. endurance
c. toughness
d. spring action
ans: A

A method whereby a gear is run with another gear that has abrasive surface material.
a. hobbing
b. honing
c. lapping
d. milling
ans. C

A multiple disc clutch of 10 steel disc and 9 bronze disc. the effective outside and inside diameter are 20.32 cm and 15.24 cm, respectively if the axial force of 450 Newton is applied and the shaft turns at 1200 rpm, find the horsepower capacity, assume a coefficient of friction of 0.27.
a. 39.566 hp
b. 40.482 hp
c. 37.456 hp
d. 35. 659 hp
Ans: A

An engine of a motor vehicle with a wheel diameter of 712 mm develops 50 kW at 2,000 rpm. the combined efficiency of the differential and tranmission is 75% with an overall speed reduction of 25 is to 1. Determine the speed reduction of travel of the vehicle in km/hr.

a. 10.74
b. 11.69
c. 12.58
d. 13.80
Ans: A

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a. 10.74
b. 11.69
c. 12.58
d. 13.80
Ans. A

An engine of a motor vehicle with a wheel diameter of 712 mm develops 50 kW at 2,000 rpm combined efficiency of the differential and transmission is 75% with an over-all speed reduction to. 1 determine he torque to be delivered by the clutch N-m.
a. 239 N-m
b. 359 N-m
c. 432 N-m
d. 471 N-m
Ans: A

The large diamter and face of the disk of a multiple disk clutch are 255 mm and 25 mm respectively the helical compression spring used to engage the clutch has 9 and 1/2 effective coils of 10 mm steel wire. the outer coil diameter is 80 mm. the free length of the spring is 185 mm. when in place with clutch engaged, its length is 130 mm. Assuming that there is 10 pairs of friction surface in contact, that the motor runs at 1200 rpm, f=0.15, determine axial force available for the clutch.
a. 1,688 N
b. 2,493 N
c. 1,542 N
d. 2,783 N
Ans: A

A flange bolt coupling consist of eight steel 20 mm diameter steel bolts spaced evenly around a bolt circle 300 mm in diamter. if the coupling is subjected to a torque of 15.1 KN-m, determine the maximum shearing stress in the bolts?
a. 40450 kPa
b. 63320 kpa
c. 40054 kpa
d. 31298 kpa
Ans: C

a flange coupling is to be designed, using 25 mm diameter bolts at a distance of 152 mm from the center of the shaft. allowable shearing stress on the bolt is 103 Mpa. if the shaft is to transmit 5,600 hp at a speed of 1200 rpm, how many bolts are needed in the connection?
a. 2
b. 3
c. 4
d. 5
Ans: D.

Two short shaft identical diameter 38.1 mm and rotating ….
a. 30.4 kW
b. 28.5 kW
c. 29.3 kW
d. 32.3 kW
Ans:B

Two short shaft identical diameter 38.1 mm and rotating ….
a. 19.30 mm
b. 22.37 mm
c. 20.40 mm
d. 16.32 mm
Ans: D

What is material is produced if austenite is cooled rapidly to 400 deg. F or less?
a. Bainite
b. Fermite
c. Martensite
d. Lignite
Ans: C

Stainless steels are iron-based alloys that contain at least how many percent chromium?
a. 45%
b. 25%
c. 12%
d. 5%
Ans: C

The very high carbon steels have good quench-harden ability up to how many percent chromium?
a. 35%
b. 12%
c. 18%
d. 15%
Ans: C

A widely used in tool steels considering that the will maintain its hardness even it is red heat. The effect is like molybdenum, except it is to be added in greater quantities.
a. Vanadium
b. Manganese
c. Tungsten

d. Nickel
Ans: C

Which of the following is the most widely used cast materials?
a. White cast iron
b. Gray cast iron
c. Malleable cast iron
d. Nodular cast iron
Ans: B

What is the result if all the carbon in cast iron is in the form of cementite and pearlite with not graphite present?
a. White
b. Gray
c. Malleable
d. Nodular
Ans: A

Which of the following is a characteristic of aluminium and its alloys?
a. Resistance to corrosion
b. High thermal and electrical resistance
c. Strength to weight ratio
d. All of these
Ans: D

The corrosion resistance of aluminium alloys depends upon which of the following?
a. Thin coating oxide
b. Percentage of electrolyte present
c. Dissolve ferrite
d. Casting of the material
Ans: A

A spherical shell of 1.8 m of outside diameter and 1.725 m inside at a pressure of 10.4 MPa. Compute the stress in the shell.

a. 124.8 Mpa
b. 119.6 Mpa
c. 96.48 Mpa
d. 88.46 Mpa
Ans: B

A thin hollow spheres of radius 10 in and thickness 0.1 in is subjected to an internal pressure of 100 psig the maximum normal stress on an element of the sphere is:
a. 5,000 psi
b. 7,070 psi
c. 14,140 psi
d. 2,500 psi
Ans: A

Pressurized water at 1.37 Mpa is stored in a steel cylindrical tank 1.4 meters in diameter. If the allowable tangential stress is 8.5 Mpa, find the required wall thickness of the tank.
a. 123.6 mm
b. 130.5 mm
c. 112.9 mm
d. 135.1 mm
Ans: A

A mechanical press is used to punch 6 holes per holes is 25 mm diameter and the plates has an ultimate strength in shear of 420 Mpa. The normal operating speed 200 rpm. And it slows down to 180 rpm during the process of punching. The flywheel has a mean diameter of one meter and the rim width is 3 times the thickness. Assume that the hub and arm account for 5% of the rim weight concentrated at the mean diameter and the density of cast iron is 7200 kg per cubic meter. Find the power in kW required to drive the press.
a. 1.310 kW
b. 5.57 kW
c. 8.92 kW
d. 9.03 kW
Ans: A

Find the weight of the flywheel needed by a machine to punched every stroke plane. The machine is to make 30 strokes per minute and a hole must be punched every stroke. The hole is to be formed during 30 degrees rotation of the puncher's crankshaft. A gear train with a ratio of 12 to 1 is to connect the flywheel shaft to the crankshaft. Let the mean diameter of a flywheel rim to be 91.44 cm. the minimum flywheel speed is to be 90% of the maximum and assume mechanical efficiency of the machine to be 80%. Assume an ultimate stress of 49000 psi.
a. 1.310 kW
b. 5.57 kW
c. 8.92 kW
d. 9.03 kW
Ans: A

Find the weight of the flywheel needed by a machine to punch 20.5 mm holes in 15.87 mm thick steel plate. The machine is to make 30 strokes per minute and a hole be punched every stroke, the hole is to be formed during 30 degrees rotation of the puncher crankshaft. A gear train with a ratio of 12 to 1 is to correct the flywheel shaft to the crankshaft. Let mean diameter of a flywheel rim to the 91.44 cm. the manimum flywheel speed is to be 90% of the maximum and assume mechanical efficiency of the machine to be 80% Assume an ultimate stress of 49000 psi.
a. 68 kg
b. 97 kg
c. 90 kg
d. 92 kg
Ans: B

It is found that the shearing machine requires 205 joules of energy to shear a specific gauge of sheet metal. The mean diameter of the flywheel is to be 76.2 cm. the normal operating speed is 200rpm and slow down to 180 rpm during shearing process. The rim width is 30.48 cm and the weight of cast iron is 7,196.6 kg/m^3, find the thickness of the rim, assuming that the hub and arm account for 10% of the rim weight concentrated on the mean diameter.
a. 0.583 cm
b. 0.587 cm
c. 0.672 cm
d. 0.480 cm
Ans: B

Which of the following cannot be a Poisson's ratio of material?
a. 0.35
b. 0.20
c. 0.57
d. 0.12
Ans: C

Type of roller bearing in which the balls are assembled by the eccentric displacement of the inner ring.
a. Shallow groove ball bearing
b. Self-alignning ball bearing
c. Fillinf-shot ball bearing
d. Deep-groove ball bearing
Ans: D

Which of the following is not a type of ball bearing?
a. Shallow groove ball bearing
b. Self-aligning ball bearing
c. Filling-slot ball bearing
d. Deep-groove ball bearing
Ans: A

Which of the following is the approximate density of the leather belt?
a. 0.025 lb/in^3
b. 0.035 lb/in^3
c. 0.0135 lb/in^3
d. 0.0465 lb/in^3
Ans: B

The breaking strength of oak-tanned beltings varies from 3 to more than:
a. 5 ksi
b. 7 ksi
c. 6 ksi
d. 9 ksi
Ans: C

Based on experience, what is the most economical design belt speed?
a. 6000 to 7500 fpm
b. 3500 to 4700 fpm
c. 3000 to 5000 fpm
d. 5000 to 1000 fpm
Ans: A

The tension in the belt due to centrifugal force increasing rapidly above about
a. 1500 fpm
b. 3500 fpm
c. 3000 fpm
d. 2500 fpm
Ans: D

What is the recommendation speed for leather belt?
a. 6000 to 7000 fpm
b. 7000 to 8000 fpm
c. 5000 to 6000 fpm
d. 4500 to 5600 fpm
Ans: B

What is the recommended speed for fabric belts?
a. 4000 to 5000 fpm
b. 2000 to 3000 fpm
c. 3000 to 4000 fpm
d. 2000 and more fpm
Ans: A

A tubular shaft, having an inner diameter of 30 mm and an outer diameter of 42 mm, is to be used to transmit 90 kW of power, determine the frequency of rotation of the shaft so that the shear stress cannot exceed 50 Mpa.
a. 26.6 Hz
b. 20.6 Hz
c. 97.5 Hz
d. 66.5 Hz
Ans: A

Two circular shaft, one hollow and one solid, are made of the same material and have diameter as follows: hollow shaft inside diameter is one-half of the external diameter. The external diameter is equal to the diameter of the solid shaft. What is the ratio of the twisting moment of the hollow shaft to that of the solid shaft?
a. ¼
b. ½
c. 9/16
d. 15/16
Ans: D

Determine the thickness of hollow shaft having an outside diameter of 100 mm if it is subjected to a maximum torque of 5,403.58 N-m without exceeding a shearing stress of 60 Mpa or a twist of 0.5 degree per meter length of shaft G=83,000 Mpa
a. 15 mm
b. 86 mm
c. 16.8 mm
d. 14.2 mm
Ans: A

A hollow shaft with outside diameter of 14 cm, and wall thickness of 0.8 cm, transmits 200 kW at 500 rpm. What must be the angular deflection of the shaft it the length in 5 meters? The material of the shaft is C4140 steel.
a. 21.41 rad
b. 21.71 rad
c. 36.80 rad
d. 17.37 rad
Ans. D

A 1 1/4 in by 7/8 in. key is to be designed for a 12.7 cm shaft which will transmit power of 150 KW at 360 rpm. If the allowable shear stress for the key is 920 kg/cm^2 and the allowable compressive stress is 1300 kg/cm^2. Determine the length of key to be used.
a. 2.41 cm
b. 2.73 cm
c. 4.42 cm
d. 4.79 cm
Ans. C

A pulley is keyed to a 2 and 1/2 inches diameter shaft by a 7/16 in x 3 in flat key. The shaft rotates at 50 rpm. The allowable compressive stress for the key, hub and shaft are 66 ksi. 59 ksi and 72 ksi, repectively. Determine the maximum torque the pulley can safety deliver.
a. 48398.4 in-lb
b. 54140.6 in-lb
c. 51562.5 in-lb
d. 67495.2 in-lb
Ans. A

Which of the following is the statement of how the total moment is derived from a number of forces acting simultaneously at a point?
a. Goodman’s theorem
b. Varignon’s theorem
c. Soderberg’s theorem
d. Cataligno’s theorem
Ans. B

It is the measure of the material’s ability to yield and absorb highly localized and rapidly applied stresses.
a. Hardness
b. Toughness
c. Stiffness
d. Resilience
Ans. B

What is term applied to the load at which a column fails?
a. Maximum load
b. Moving load
c. Critical load
d. Dynamic load
Ans. C

It is otherwise known as the percentage difference in solid and working deflections?

a. Clash allowance
b. Spring allowance
c. Working allowance
d. Thrust allowance
Ans. C

It is known as the shaft's natural frequency of vibration.
a. Vibration index
b. Critical speed
c. High speed
d. Low speed
Ans. B

What do you call the mixture of the solid ingredients with no solubility?
a. Binary alloy
b. Miscible alloy
c. Bitectic material
d. Eutectic alloy
Ans. D

Which of the following terms applied to an interrupted quenching process resulting in an austenite to banite transition?
a. Austempering
b. Austenitizing
c. Martempering
d. Martenitizing
Ans. A

Which of the following processes where the material will become progressively stronger, harder and more brittle until eventually fails?
a. Hot working
b. Cold Working
c. Tempering
d. Normalizing
Ans. B

…. to engage the clutch?
a. 600 lbs
b. 715 lbs
c. 625 lbs
d. 800 lbs
Ans. B

A set screw 12 mm effective diameter is broken by a force of 410 N on the end of a spanner 300 mm long. Find the torque to break a set screw of 16 mm effective diameter if its breaking stress is 10% greater than the former.
a. 320.6 N-m
b. 223.5 N-m
c. 230.5 N-m
d. 345.6 N-m
Ans. A

A Warwick screw is used to tighten a guy rope. It has right-hand thread of 10 mm pitch at the top and a left-hand thread of 5 mm pitch at the bottom, and the effective radius of the toggle bar is 336 mm. Find the velocity.
a. 220.6
b. 130.5
c. 140.8
d. 210.5
Ans. C

A 4 inches diameter shaft is driven at 3600 rpm by a 400 Hp motor. The shaft drives a 48 inches diameter chain sprocket having an output efficiency of 85%. The output force of the driving sprocket and the output of the driven sprocket are:
A. 200 lb and 250 hp
B. 261.6 lb and 300 hp
C. 291.66 lb and 340 hp
D. None of the above
Ans. C

A certain farm equipment which requires 2200 Newton mater torque at 500 RPM has a diesel engine to operates at 1500 RPM as its prime mover. A No. 60 roller chain with a total length of 60 pitches and a small sprocket with 23 teeth are to be used with an operating temperature to remain constant at 45 degree C. Determine the no. of teeth of the larger sprocket.
A. 70
B. 69
C. 68
D. 69
Ans. D

A sleeve bearing has an outside diameter of 1.5 in and a length of 2 in, the wall thickness is 3/16 in. The bearing is subjected to a radial load of 450 lb. Find the bearing pressure.
A. 100 psi
B. 150 psi
C. 200 psi
D. 250 psi
Ans. C

Find the torsional deflection, in degrees of a solid steel shaft 110 mm OD 1.4 m long subjected to 3.1 x 10^{6} N-mm. The torsinal modulus of elasticity is 80,000 N/mm-mm
A. 0.22
B. 0.195
C. 0.28
D. 0.24
Ans. A

A cut gear transmits 25 Hp at a pitch line velocity of 6000 ft/min. If the service is intermittent the dynamic load is:
A. 244
B. 264
C. 274
D. 284
Ans. C

An internal gearing requires an idler gear if the driving gear of 6 inches in diameter and the center distance of the idler to the driver is 20 inches. What is the inside diameter of the driven gear?
A. 62
B. 70
C. 74
D. 81
Ans. C

In a standard bevel gear, the pinion rotates at 150 rpm, its number of teeth is 14 while the gear has 42 teeth, what is the pitch angle of the pinion?
A. 18.4 degrees
B. 20 degrees
C. 14.5 degrees
D. 20.5 degrees
Ans. A

In damped free vibration, when the system returns to its static position with the …… equilibrium, the system is said to be
A. Underdamped

B. Overdamped
C. Resonant
D. Critically damped

Ans. D

Balancing o grinding wheel is done to
A. Make the outside diameter concentric with the bore
B. Make the sides of wheel parallel
C. Equalize the weight in every portion of the wheel
D. None of the above

Ans. C

A grinding wheel is marked as 51A 46L 5V 23, out of these 5 means
A. Kind of abrasive
B. Structure
C. Kind of bond
D. Grain size

Ans. B

It is also known as diamond pyramid hardness test, uses a pyramid shaped diamond indenter and a load that ranges from 1 kg to 120 kg.
A. Vickers test
B. Mohs hardness
C. Knoop test
D. Brinell test

Ans. A

The maximum moment induced in a simply supported beam of 20 foot span, by a 2,000 pound load at midspan is
A. 125,000 ft-lbs
B. 15,000 ft-lbs
C. 30,000 ft-lbs
D. 10,000 ft-lbs

Ans. D

A 10" diameter pulley is belt driven with a net torque of 250 ft-lbs. The ratio of tensions in the tight to stack sides of the belt is 4 to 1. What is the maximum tension in the belt?
A. 250 lbs.
B. 800 lbs.
C. 83 lbs.
D. 500 lbs.

Ans. B

Compute how many 3/8 inch diameter set screws required to transmit 3 Hp at a shaft speed of 1000 rpm. The shaft diameter is 1 inch

A. 1 ½
B. 2
C. 3
D. 1

Ans. B

A drop hammer of 1 ton dead weight capacity is propelled downward by a 12 inch diameter cylinder. At 100 psi air pressure what is the impact velocity if the stroke is 28 inches?
A. 47.4 ft/sec
B. 31.6 ft/sec
C. 15.8 ft/sec
D. 63.2 ft/sec

Ans. B

A link has a load factor of 0.8 the surface factor 0.8, the surface factor is 0.92 and the endurance strength is 28000 psi. Compute the alternating stress of the link if it is subjected to a reversing load. Assume a factor of safety of 3.
A. 8150
B. 10920
C. 9,333
D. 7260

Ans. C

Determine the average time to cut by automatic oxy-acetylene (machine) crosswise a 4ft x 8ft x 4in thick steel plate.
A. 6.85 min.
B. 318 sec
C. 10 min
D. 360 sec

Ans. D

A 16 mm plate is lapped over and secured by fillet weld on the inside and outside to form a penstock 1.5 meter in diameter. Determine the safe internal pressure, assuming an allowable stress of 140 MPa on the plate and an allowable shear stress of 90 MPa on the throat side of the 14 mm fillet weld.
A. 2.376 MPa
B. 3.590 MPa
C. 2.843 MPa
D. 1.695 Mpa

Ans. A

Which of the following dynamometer is widely used for absorption of wide range of powers at wide range of speeds?
A. Hydraulic
B. Belt transmission
C. Rope brake
D. Electric generator

Ans. A

Which of the following dynamometer is used for power measurement when the speed is high and the viscous force is small?
A. Tesla fluid friction dynamometer
B. Froude water vortex dynamometer
C. Rope brake dynamometer
D. Amsler dynamometer

Ans. A

In case of spur gears the flank of the tooth is
A. The part of the tooth surface lying below the pitch surface’
B. The curve forming face and flank
C. The width of the gear tooth measures axially along the pitch surface
D. The surface of the top of the tooth

Ans. A

The cam angle is
A. The angle of rotation of the cam for a definite displacement of the follower
B. Angle subtended by live portion of cam at the cam center’
C. The angle subtended at the cam center by the portion of cam during which the follower moves
D. The angle subtended by the cam at the cam center when the follower dwells.

Ans. A

For a kinematic chain to be considered as mechanism
A. None of the links should be fixed
B. One link should be fixed
C. Two links should be fixed

D. There is no such criterion
Ans. B

Slip in belt drive is
A. Loss of power
B. Difference between the angular velocities of two pulleys
C. Difference between the velocities of two pulleys
D. Difference between the linear speed of the rim of pulley and the belt on it.
Ans. D

Multiple collars are provided on a flat collar pivot bearing to
A. Increase frictional resistance
B. To establish self-sustaining bearing condition
C. Distribute the frictional load due to limiting friction
D. Distribute the axial load due to limiting bearing pressure on a collar
Ans. D

In gramophones for adjusting the speed of the tum-table, the following type of governor is commonly used
A. Hartung governor
B. Inertia governor
C. Pickering governor
D. Wilson hartnell
Ans. C

Shearing the sheet into two or more pieces
A. Parting
B. Perforating
C. Lancing
D. Notching
Ans. A

The mechanism used to enlarge or reduce moments for reproducing drawings to different scales is called
A. Clinograph
B. Trisquare
C. Graphometer
D. Bantograph
Ans. D

Which of the following is a higher pair?
A. Thomson an indicator mechanism
B. Double Mc Innes Indicator mechanism
C. Hart’s straight line mechanism
D. Tooth gearing mechanism
Ans. D

A process of indenting but not breaking through the surface of a workpiece with a punch in order to produce a cavity of an impression
A. Heading
B. Cogging
C. Barreling
D. Piercing
Ans. D

A turbine developing 15,000 Hp turns the shaft at 300 rpm. The propeller attached to this shaft develops a thrust of 150,000 lb. A hollow steel shaft having an outside diameter of 14 in. is to be used. Determine the inside diameter of the shaft if the maximum shearing stressed based on the torsion alone is not to exceed 7500 psi. What is the percentage savings in weight.

Ans. %W saving = 37.3%

A short compression member with Do= 2Di is to support a dead load of 25 tons. The material is to be 4130. A short compression member with Do= 2Di is to support a dead load of 25 tons. The material is to be 4130 steel, WQT 1100^{o}F. Calculate the outside and inside diameters on the basis of yield strength of 114 ksi and factor of safety of 2.

Ans. Do=1.22 in. and Di=0.61 in.

A 15/16-in wide key has a depth of 5/8 in. It is 12 inches long and is to be used on a 200 hp, 1160 rpm, squirrel-cage induction motor. The shaft diameter is 3 7/8 inches. The maximum running torque is 200% of the full-load torque. Determine the maximum compressive stress of the key
A. 779 psi
B. 997 psi
C. 197 psi
D. 279 psi
Ans. B

A storage tank for air, 36 inche in diameter, is to withstand an internal pressure of 200 psi with a design factor of 4 based on Su. The steel has the strength equivalent to C1020 annealed and the welded joints should have a relative strength (efficiency) of 90%. If Su for annealed C1020 steel is 57 ksi. Compute the longitudinal stress.
A. 128,000 psi
B. 21,000 psi
C. 800,000 psi
D. 12,800 psi
Ans. D

The mass of a flywheel is 175 kg and its radius of gyration is 380 mm. Find the torque required to attain a speed of 500 rpm from rest in 30 seconds.
A. 40.46 N
B. 44.12 N
C. 35.66 N
D. 38.48 N
Ans. B

A steel bar 24 in. in length is to withstand a tensile impact load caused by a weight of 100 lb having a velocity on impact of 140 fpm. Find the stress in the bar if the diameter is 1 ½ in and the modulus of Elasticity (E) is 30x10^{6} psi.

Ans. S=12,000 psi

The cylinder head of a 10in x 18in. freon compressor is attached by 10 stud bolts made of SAE grade 5. The cylinder pressure is 300 psi. What is the approximate tightening torque should be used to induce a tightening stress (St) of 0.90 times the proof stress if the diameter of the bolt is 5/8 in and coefficient of collar friction c = 0.2?

Ans. T = 2161 in-lb

Calculate the power consumed during cutting of a low carbon steel bar 40 mm diameter if cutting force is 150 kg at 200 rpm.
A. 0.46 hp
B. 0.66 hp
C. 0.75 hp
D. 0.83 hp
Ans. D

A broach is used to cut a key way 8mm wide, 5mmm deep in a boss 64mm long. Determine the cutting

length of broach if the rise per tooth is 0.0875mm and the number of finishing teeth is 13.
A. 672 mm
B. 627 mm
C. 762 mm
D. 726 mm
Ans. C

Calculate the power of electric motor for a drilling machine to drill a hole 15 mm diameter in cast iron workpiece at 450 rpm and 0.2 mm feed. The specific power is 0.03 kW and efficiency of motor is 80%.
A. 0.6 kW
B. 0.9 kW
C. 0.7 kW
D. 0.4 kW
Ans. A

A double square thread screw is used to raise a load of 20,000 lb at a velocity of 3 fpm. Outside diameter of thread and pitch are 2 7/8 in. and 1 in. respectively. Collar friction coefficient is 0.12, thread friction coefficient is 0.10. Mean diameter of collar 5 in. Determine the power required to drive the screw.
A. 3.45 hp
B. 4.29 hp
C. 4.65 hp
D. 5.02 hp
Ans. B

Two 2 ¾ in sellers standard square thread screws are used to raise and lower a hydraulic gate weighing 60 tons. A 570 rpm electric motor operates the screws. The coefficients of collar and thread friction are 0.03 and 0.14 respectively. The mean diameter of the collar 4in. if the gate rises at the rate of 2fpm, determine the size of the motor required to lift the gate if the mechanical efficiency is 85% for the speed reducing equipment.
A. 20 hp
B. 30 hp
C. 34 hp
D. 24 hp
Ans. C

A crate weighing 4,000 lb is moving at a speed of 4ft/s. It is brought to rest by two compression spring in stopping the crate, the springs are to be compressed 8 in. If the spring index is 6 and the allowable stress is 52,000 psi, determine the maximum load on each springs.
A. 1491 lbs
B. 2037 lbs
C. 1675 lbs
D. 2453 lbs
Ans. A

What describes very rough grinding such as that performed in foundries to remove gates, fins and risers from castings?
A. Snagging
B. Honing
C. Lapping
D. Snugging
Ans. A

Which of the following is a single measure that combines the external dynamic load of an application with a gear drive’s reliability and operating life?
A. Ratio factor
B. Service factor
C. Reliability factor
D. Life factor
Ans. C

What is the term used to described the distance from a point on one gear to the corresponding point measures along the base circle.
A. Diametral Pitch
B. Circular Pitch
C. Normal Pitch
D. Chordal pitch
Ans. C

Which of the following is the best method used for increasing a spring’s fatigue life?
A. Sprickling
B. Shot peening
C. Stress relieving
D. Shot relieving
Ans. B

What is the term applied to parallel forces equal in magnitude but opposite direction?
A. Concurrent forces
B. Non-concurrent forces
C. Couple
D. Equillibrant
Ans. C

It is one of the rigid members / bodies joined together to form a kinematic chain.
A. Coplanar
B. Link
C. Frame
D. Machine
Ans. B

The kinematics chain in which one link is considered fixed for the purpose of analysis but motion is possible in other links.
A. Belting
B. Mechanism
C. Frame
D. Sprocket Chain
Ans. C

What describes very rough grinding, such as that performed in foundries to remove gates, fins and risers from castings?
A. Snagging
B. Honing
C. Lapping
D. Snugging
Ans. A

Two spur wheels in gear transmit a power 6.7 kW. The driver has 40 teeth of 12 mm pitch and runs at 7 rev/s,find the force on the teeth.
a. 2.0 kN
b. 1.0 kN
c. 3.0 kN
d. 4.0 kN

Ans. A

TIGERS NAULIT NA ITO!!! PRACTICE!

An ammonia compressor is driven by a 20kW motor. The compressor and the motor RPM are 380 and 1750, respectively. The small sheave has a pitch diameter of 152.4 mm. If the bolt to be used is standard C-120 (L=122.9in.). Determine the center distance between sheaves
709
A. 865 mm
B. 806 mm
C. 686 mm
Ans. C

A safety valve spring having 9 and ½ coils has the ends squared and ground. The outside diameter of the coil is 115 mm and the wire is 13 mm. It has a free length of 203 mm. Determine the length of the wire to which this spring must be initially compressed to hold a boiler pressure of 1.38 MPa on the seat of 32 mm diameter. Modulus of rigidity is taken as $G=80GN/m^2$.
E. 172
F. 179
G. 192
H. 158
Ans. A

A single threaded trapezoidal metric thread has a pitch of 4 mm, and a mean diameter of 18 mm. It is used as a translation screw in conjunction with a collar having an outside diameter of 37 mm and an inside diameter of 27 mm. Find the required torque in N-m to raise a load of 400 kg if the coefficient of friction is 0.3 for both thread and collar.
E. 34.6 N-m
F. 32.6 N-m
G. 39.1 N-m
H. 38.5 N-m
Ans. B

Determine the diameter of the stud bolt that are required to fasten down the cylinder head of a 203 mm x 304 mm gas engine. There are ten bolts on the block. The explosion pressure is 31 kg/sq.cm and studs are made of ordinary bolts material SAE 1020. How deep should the bolt be drilled?
E. 38.1 mm
F. 40.2 mm
G. 37.3 mm
H. 35.5 mm
Ans. A

A single square thread power screw is to raise a load of 70 kN. The screw has a major diameter of 36 mm and a pitch of 6 mm. The coefficient of thread friction and collar friction are 0.13 and 0.10 respectively. If the collar mean diameter is 90 mm and the screw turns at 60rpm, find the combined efficiency of screw and collar.
E. 13.438%
F. 15.530%
G. 14.526%
H. 12.526%
Ans. D

Find the horsepower required to drive a power screw lifting a load of 4000 lbs. A 2 and ½ inches double square thread with two threads/in is to be used. The friction radius of the collar is 2 inches and the coefficients of friction are 0.1 for the threads and 0.15 for the collar. The velocity of the nut is 10 ft/min.
E. 5.382 HP
F. 4.395 HP
G. 3.683 HP
H. 6.472 HP
Ans. B

A flywheel has a mean diameter of 4 ft and is required to handle 2200 ft-lb of kinetic energy. The flywheel has a width of 8in. Normal operating speed is 300 rpm and the coefficient of fluctuation is to be 0.05. Find the weight of the rim assuming that the arms and hub are equivalent is 10% of the specific weight.
E. 412 lb
F. 334 lb
G. 452.4 lb
H. 533 lb
Ans. B

Find the rim thickness for a cast iron flywheel with a width of 200 mm, a mean diameter of 1.2 in a normal operating speed of 300 rpm, a coefficient fluctuation of 0.05 and which is capable of hanging 3000 N-m of kinetic energy. Assume that the hub and arms represent 10% of the rim weight and the specific weight of cast iron is 7200 kg/m^3
E. 25.28 mm
F. 28.82 mm
G. 28.25 mm
H. 25.25 mm
Ans. C

A cast iron flywheel is rotated at a speed of 1200 rpm and having a mean rim radius of 1 foot. If the weight of the rim is 30 lbs. What is the centrifugal force? Use factor C=41.
E. 14,800 lbs
F. 70,000 lbs
G. 14 800 lbs
H. 14,700 lbs
Ans. D
The maximum-strain theory which apples only in elastic range of stresses are also known as _____

E. Hooke’s Law
F. Saint Venant’s Theory
G. Stress-strain Theory
H. Cataligno’s Theory
Ans. B

It refers to the collision of two or more masses with initial velocities.
E. Shock
F. Impact
G. Creep
H. Load
Ans. B

A term used to describe sudden applied force or disturbance.
E. Shock
F. Impact
G. Creep
H. Load
Ans. A

A cone-disk spring is also known as _____
E. Believille Spring
F. Heavy duty spring
G. Helical spring
H. Conical spring
Ans. A

What is the other term used for die casting?
E. Thermosetting
F. Shell-molding
G. Metal-mold casting
H. Tangential casting
Ans. C

It is a cold-working process in which metal is gathered or upset.
E. Heading
F. Cold rolling
G. Spinning
H. Stamping
Ans. A

Which of the following is the high-leaded brass used for instrument, lock and watch parts?
E. Red brass
F. Commercial brass
G. Yellow brass
H. Engraver’s brass
Ans. D

The rapid cooling of steel to a temperature between 400 to 800 deg F in enough time, then austenite is transformed into a materials called.
E. Bainite
F. Lignite
G. Quinite
H. Ferrite
Ans. A

A centrifugal pump is directly couple to a motor. The pump rating is 3,600 liters per minute against a total head of 8 meters of water. Pump efficiency is 65% at shaft speed of 550 rpm. Calculate the torsional stress induced on the 40 mm diameter motor shaft.
E. 11,193.45 kPa
F. 12,420.72 kPa
G. 10,010.85 kPa
H. 13,113.83 kPa
Ans. C

A 80 mm solid shaft is to be replaced with a hallow shaft of equal torsional strength. Find percentage of weight saved, if the outside of the hallow shaft is 100 mm.
E. 56.53%
F. 67.31%
G. 48.49%
H. 52.90%
Ans. D

A solid transmission shaft is 4.0 inches in diameter. It is desired to replace it with a hallow shaft of the same material and same torsional strength but its weight should only be half as much as the solid shaft. Find the outside diameter of the hallow shaft in millimeters.
E. 107.315 mm
F. 112.231 mm
G. 122.940 mm
H. 131.204 mm
Ans. C

A railroad track is laid at a temperature of 10 degree F with gaps of 0.01 feet between the ends of the rails. The rails are 33 feet long. If they are prevented from buckling, what stress will result from a temperature of 110 degree F? Coefficient of linear expansion = $6.5x10^{6}$ per degree F.
E. 10,000 psi
F. 8,530 psi
G. 9,450 psi
H. 10409 psi
Ans. D

What load P which causea total deformation of 0.036 inch of a steel rack which has a cross-section area of 4 sq. inches and a length of 5 ft.
E. 55,000 lb
F. 72,000 lb
G. 60,000 lb
H. 50,000 lb
Ans. B

A lubrication where lubricant is introduced between surfaces which are in rolling contact such as roller gears or rolling bearings?
E. Hydrostatic lubrication
F. Hydrodynamic lubrication
G. Elastohydrodynamic lubrication
H. Solid-film lubrication
Ans. C

What lubrication is usually used when bearings are operating at extreme temperatures?
E. Hydrodynamic lubrication
F. Solid-film lubrication
G. Hydrostatic lubrication
H. Liquid-film lubrication
Ans. B

Which of the following is not a form of bearing lubrication?
E. Liquid-film lubrication
F. Hydrodynamic lubrication
G. Hydrostatic lubrication
H. Solid-film lubrication
Ans. A

In ASTM standard, what is the instrument used in determining viscosity?
E. Dynamic viscometer
F. Saybolt universal furol
G. Hagen-Poinsulle viscometer
H. Saybolt universe viscometer
Ans. D

In what country that the present theory of hydrodynamic lubrication originates from?
E. China
F. Germany
G. US
H. England
Ans. D

In viscosity chart, Raimond-Boyd analysis assumed that the viscosity of the lubricant is _____
E. Constant
F. Increasing
G. Decreasing
H. Vanishing
Ans. A

What do you call the phenomenon occurring when two touching surfaces have a high contact pressure and when these surfaces have minute relative motion?
E. Prestressing
F. Friction
G. Fretting
H. Carving
Ans. C

What type of bolt threaded on both ends and can be used where a through bolt impossible?
E. Coupling
F. Stud bolt
G. Carriage bolt
H. Machine bolt
Ans. B

What type of bolt distinguished by a short potion of the shank underneath the head being square or finned or ribbed?
E. Coupling
F. Stud bolt
G. Carriage bolt
H. Machine bolt
Ans. C

What is the term applied to the reciprocal of the velocity ratio?
E. Train value
F. Modular value
G. Ratio factor
H. None of these
Ans. A

For very slender column, what type of formula that is best applied?
E. Column formula
F. Moment formulas
G. Slenderness formulas
H. Euler formula
Ans. A

Which of the following is the type of failure due to unstability?
E. Buckling
F. Stability
G. Slenderness formulas
H. Euler formula
Ans. A

What type of spring made in the form of dished washer?
E. Air spring
F. Volute spring
G. Believille spring
H. Motor spring
Ans. C

What is the minimum number of teeth on a smaller sprocket for high speed?
E. 12
F. 21
G. 24
H. 14
Ans. B

Which of the following is the minimum number of teeth on a smaller sprocket for moderate speed?
E. 15
F. 12
G. 21
H. 17
Ans. D

What is the minimum number of teeth on a smaller sprocket for low speed?
E. 11
F. 17
G. 21
H. 12
Ans. 12

Two shaft at right angles to each other may be connected by what arrangement?
E. Half turn
F. ¾ turn
G. Quarter turn
H. One turn
Ans. C

What is the recommended initial tension of the belt?
E. 75 lb/in of width
F. 71 lb/in of width
G. 73 lb/in of width
H. 80 lb/in of width
Ans. A

What factor of safety is needed for a 2 in. diameter shaft with an ultimate strength of 50,000 psi to transmit 40,000 in-lb torque.
E. 2.25
F. 1.95
G. 2.14
H. 2.62
Ans. D

A round steel shaft transmits 373 watts at 1800 rpm. The torsional deflection is not to exceed 1 deg in a length equal to 20 diameters. Find the shaft diameter.
E. 6.53 mm
F. 8.72 mm
G. 12.84 mm
H. 18.16 mm
Ans. A

A steel shaft operates at 186 rad/s and must handle 2 kW of power. The shearing stress is not to exceed 40 MN/m^2. Calculate the minimum shaft diameter based on pure torsion.
E. 9 mm
F. 11 mm
G. 13 mm
H. 15 mm
Ans. B

A 100 mm diameter solid shaft is to be replaced with a hollow shaft equally strong (torsion) and made of the same material. The outside diameter of the hollow shaft is to 27 mm. What should be the inside diameter? The allowable shearing stress is 41.4 MPa?
E. 107.42 mm
F. 105.82 mm
G. 291.53 mm
H. 109.60 mmw
Ans. A

If the weight of 6″ diameter by 48″ long SAE 1030 shafting is 174.5 kg then what will be the weight of chromium SAE 51416 of same size?
E. 305.79 lbs
F. 426.70 lbs
G. 347.96 lbs
H. 465.89 lbs
Ans. C

A 50 inches diameter diamond saw blade is mounted on a pulley driven steel shaft, required a blade peripheral linear speed of 150 ft/sec. Motor drive is 125 hp at 1,200 rpm, with 6 inches diameter pulley. Determine the shaft rpm to attain blade peripheral speed required.
E. 716.2 rpm
F. 635.3 rpm
G. 539.10 rpm
H. 687.55 rpm
Ans. D

A steel shaft transmits 40 hp at 1400 rpm. Considering allowable shearing stress based on pure torsion to be 5000 psi, find the torsional deflection of the shaft in degrees per foot.
E. 0.392 degrees/foot
F. 0.246 degrees/foot
G. 0.541 degrees/foot
H. 0.435 degree/foot
Ans. B

The process by which high pressure is applied to a heated metal billet or blank which causes it to flow through restricted orifice.
E. Extrusion
F. Intrusion
G. Forging
H. Hot rolling
Ans. A

A tolerance where the size of a part is permitted to be either larger or smaller than the given dimension.
E. Bilateral
F. Unilateral
G. Lateral
H. None of these
Ans. A

In a pressure vessel, the ratio of minimum strength of joint to the strength of solid joint is known as
E. Efficiency
F. Performance factor
G. Joint efficiency
H. Relative strength
Ans. D

When tested in compression, ductile material usually exhibit_____ characteristics up to the yield strength as they do when tested in tension.
a. the same
b. less than
c. more than
d. approximately the same
ans. D

In pure torsion, the maximum stress is at the center of the
a. peripheral sides
b. long sides
c. medium sides
d. short sides
ans: B

The ability of a material to absorb energy within is proportional limit is known as
a. resilience
b. endurance
c. toughness
d. spring action
ans: A

A method whereby a gear is run with another gear that has abrasive surface material.
a. hobbing
b. honing
c. lapping
d. milling
ans. C

A multiple disc clutch of 10 steel disc and 9 bronze disc. the effective outside and inside diameter are 20.32 cm and 15.24 cm, respectively if the axial force of 450 Newton is applied and the shaft turns at 1200 rpm, find the horsepower capacity, assume a coefficient of friction of 0.27.
a. 39.566 hp
b. 40.482 hp
c. 37.456 hp
d. 35. 659 hp
Ans: A

An engine of a motor vehicle with a wheel diameter of 712 mm develops 50 kW at 2,000 rpm. the combined efficiency of the differential and tranmission is 75% with an overall speed reduction of 25 is to 1. Determine the speed reduction of travel of the vehicle in km/hr.
a. 10.74
b. 11.69
c. 12.58
d. 13.80
Ans: A

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a. 10.74
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c. 12.58
d. 13.80
Ans. A

An engine of a motor vehicle with a wheel diameter of 712 mm develops 50 kW at 2,000 rpm combined efficiency of the differential and transmission is 75% with an over-all speed reduction to. 1 determine he torque to be delivered by the clutch N-m.
a. 239 N-m
b. 359 N-m
c. 432 N-m
d. 471 N-m
Ans: A

The large diamter and face of the disk of a multiple disk clutch are 255 mm and 25 mm respectively the helical compression spring used to engage the clutch has 9 and 1/2 effective coils of 10 mm steel wire. the outer coil diameter is 80 mm. the free length of the spring is 185 mm. when in place with clutch engaged, its length is 130 mm. Assuming that there is 10 pairs of friction surface in contact, that the motor runs at 1200 rpm, f=0.15, determine axial force available for the clutch.
a. 1,688 N
b. 2,493 N
c. 1,542 N
d. 2,783 N
Ans: A

A flange bolt coupling consist of eight steel 20 mm diameter steel bolts spaced evenly around a bolt circle 300 mm in diamter. if the coupling is subjected to a torque of 15.1 KN-m, determine the maximum shearing stress in the bolts?
a. 40450 kPa
b. 63320 kpa
c. 40054 kpa
d. 31298 kpa
Ans: C

a flange coupling is to be designed, using 25 mm diameter bolts at a distance of 152 mm from the center of the shaft. allowable shearing stress on the bolt is 103 Mpa. if the shaft is to transmit 5,600 hp at a speed of 1200 rpm, how many bolts are needed in the connection?
a. 2
b. 3
c. 4
d. 5
Ans: D

A 4 inches diameter shaft is driven at 3600 rpm by a 400 Hp motor. The shaft drives a 48 inches diameter chain sprocket having an output efficiency of 85%. The output force of the driving sprocket and the output of the driven sprocket are:

E. 200 lb and 250 hp
F. 261.6 lb and 300 hp
G. 291.66 lb and 340 hp
H. None of the above
Ans. C

A certain farm equipment which requires 2200 Newton mater torque at 500 RPM has a diesel engine to operates at 1500 RPM as its prime mover. A No. 60 roller chain with a total length of 60 pitches and a small sprocket with 23 teeth are to be used with an operating temperature to remain constant at 45 degree C. Determine the no. of teeth of the larger sprocket.
E. 70
F. 69
G. 68
H. 69
Ans. D

A sleeve bearing has an outside diameter of 1.5 in and a length of 2 in, the wall thickness is 3/16 in. The bearing is subjected to a radial load of 450 lb. Find the bearing pressure.
E. 100 psi
F. 150 psi
G. 200 psi
H. 250 psi
Ans. C

Find the torsional deflection, in degrees of a solid steel shaft 110 mm OD 1.4 m long subjected to 3.1 x 10^{6} N-mm. The torsinal modulus of elasticity is 80,000 N/mm-mm
E. 0.22
F. 0.195
G. 0.28
H. 0.24
Ans. A

A cut gear transmits 25 Hp at a pitch line velocity of 6000 ft/min. If the service is intermittent the dynamic load is:
E. 244
F. 264
G. 274
H. 284
Ans. C

An internal gearing requires an idler gear if the driving gear of 6 inches in diameter and the center distance of the idler to the driver is 20 inches. What is the inside diameter of the driven gear?
E. 62
F. 70
G. 74
H. 81
Ans. C

In a standard bevel gear, the pinion rotates at 150 rpm, its number of teeth is 14 while the gear has 42 teeth, what is the pitch angle of the pinion?
E. 18.4 degrees
F. 20 degrees
G. 14.5 degrees
H. 20.5 degrees
Ans. A.

In damped free vibration, when the system returns to its static position with the …… equilibrium, the system is said to be
E. Underdamped
F. Overdamped
G. Resonant
H. Critically damped
Ans. D

Balancing o grinding wheel is done to
E. Make the outside diameter concentric with the bore
F. Make the sides of wheel parallel
G. Equalize the weight in every portion of the wheel
H. None of the above
Ans. C

A grinding wheel is marked as 51A 46L 5V 23, out of these 5 means
E. Kind of abrasive
F. Structure
G. Kind of bond
H. Grain size
Ans. B

It is also known as diamond pyramid hardness test, uses a pyramid shaped diamond indenter and a load that ranges from 1 kg to 120 kg.
E. Vickers test
F. Mohs hardness
G. Knoop test
H. Brinell test
Ans. A

The maximum moment induced in a simply supported beam of 20 foot span, by a 2,000 pound load at midspan is
E. 125,000 ft-lbs
F. 15,000 ft-lbs
G. 30,000 ft-lbs
H. 10,000 ft-lbs
Ans. D

A 10" diameter pulley is belt driven with a net torque of 250 ft-lbs. The ratio of tensions in the tight to stack sides of the belt is 4 to 1. What is the maximum tension in the belt?
E. 250 lbs.
F. 800 lbs.
G. 83 lbs.
H. 500 lbs.
Ans. B

Compute how many 3/8 inch diameter set screws required to transmit 3 Hp at a shaft speed of 1000 rpm. The shaft diameter is 1 inch
E. 1 ½
F. 2
G. 3
H. 1
Ans. B

A drop hammer of 1 ton dead weight capacity is propelled downward by a 12 inch diameter cylinder. At 100 psi air pressure what is the impact velocity if the stroke is 28 inches?
E. 47.4 ft/sec
F. 31.6 ft/sec
G. 15.8 ft/sec
H. 63.2 ft/sec
Ans. B

A link has a load factor of 0.8 the surface factor 0.8, the surface factor is 0.92 and the endurance strength is 28000 psi. Compute the alternating stress of the link if it is subjected to a reversing load. Assume a factor of safety of 3.
E. 8150
F. 10920
G. 9,333
H. 7260
Ans. C

Determine the average time to cut by automatic oxy-acetylene (machine) crosswise a 4ft x 8ft x 4in thick steel plate.
E. 6.85 min.
F. 318 sec
G. 10 min
H. 360 sec
Ans. D

A 16 mm plate is lapped over and secured by fillet weld on the inside and outside to form a penstock 1.5 meter in diameter. Determine the safe internal pressure, assuming an allowable stress of 140 MPa on the plate and an allowable shear stress of 90 MPa on the throat side of the 14 mm fillet weld.
E. 2.376 MPa
F. 3.590 MPa
G. 2.843 MPa
H. 1.695 Mpa
Ans. A

Which of the following dynamometer is widely used for absorption of wide range of powers at wide range of speeds?
E. Hydraulic
F. Belt transmission
G. Rope brake
H. Electric generator
Ans. A

Which of the following dynamometer is used for power measurement when the speed is high and the viscous force is small?
E. Tesla fluid friction dynamometer
F. Froude water vortex dynamometer
G. Rope brake dynamometer
H. Amsler dynamometer
Ans. A

In case of spur gears the flank of the tooth is
E. The part of the tooth surface lying below the pitch surface’
F. The curve forming face and flank
G. The width of the gear tooth measures axially along the pitch surface
H. The surface of the top of the tooth
Ans. A

The cam angle is
E. The angle of rotation of the cam for a definite displacement of the follower
F. Angle subtended by live portion of cam at the cam center’
G. The angle subtended at the cam center by the portion of cam during which the follower moves
H. The angle subtended by the cam at the cam center when the follower dwells.
Ans. A

For a kinematic chain to be considered as mechanism
E. None of the links should be fixed
F. One link should be fixed
G. Two links should be fixed
H. There is no such criterion
Ans. B

Slip in belt drive is
E. Loss of power
F. Difference between the angular velocities of two pulleys
G. Difference between the velocities of two pulleys
H. Difference between the linear speed of the rim of pulley and the belt on it.
Ans. D

Multiple collars are provided on a flat collar pivot bearing to
E. Increase frictional resistance
F. To establish self-sustaining bearing condition
G. Distribute the frictional load due to limiting friction
H. Distribute the axial load due to limiting bearing pressure on a collar
Ans. D

In gramophones for adjusting the speed of the tum-table, the following type of governor is commonly used
E. Hartung governor
F. Inertia governor
G. Pickering governor
H. Wilson hartnell
Ans. C

Shearing the sheet into two or more pieces
E. Parting
F. Perforating
G. Lancing
H. Notching
Ans. A

The mechanism used to enlarge or reduce moments for reproducing drawings to different scales is called
E. Clinograph
F. Trisquare
G. Graphometer
H. Bantograph
Ans. D

Which of the following is a higher pair?
E. Thomson an indicator mechanism
F. Double Mc Innes Indicator mechanism
G. Hart’s straight line mechanism
H. Tooth gearing mechanism
Ans. D

A process of indenting but not breaking through the surface of a workpiece with a punch in order to produce a cavity of an impression
E. Heading
F. Cogging
G. Barreling
H. Piercing
Ans. D

A turbine developing 15,000 Hp turns the shaft at 300 rpm. The propeller attached to this shaft develops a thrust of 150,000 lb. A hollow steel shaft having an outside diameter of 14 in. is to be used. Determine the inside diameter of the shaft if the maximum shearing stressed based on the torsion alone is not to exceed 7500 psi. What is the percentage savings in weight.

Ans. %W saving = 37.3%

A short compression member with Do= 2Di is to support a dead load of 25 tons. The material is to be 4130. A short compression member with Do= 2Di is to support a dead load of 25 tons. The material is to be 4130 steel, WQT 1100ºF. Calculate the outside and inside diameters on the basis of yield strength of 114 ksi and factor of safety of 2.

Ans. Do=1.22 in. and Di=0.61 in.

A 15/16-in wide key has a depth of 5/8 in. It is 12 inches long and is to be used on a 200 hp, 1160 rpm, squirrel-cage induction motor. The shaft diameter is 3 7/8 inches. The maximum running torque is 200% of the full-load torque. Determine the maximum compressive stress of the key

E. 779 psi
F. 997 psi
G. 197 psi
H. 279 psi

Ans. B

A storage tank for air, 36 inche in diameter, is to withstand an internal pressure of 200 psi with a design factor of 4 based on Su. The steel has the strength equivalent to C1020 annealed and the welded joints should have a relative strength (efficiency) of 90%. If Su for annealed C1020 steel is 57 ksi. Compute the longitudinal stress.

E. 128,000 psi
F. 821,000 psi
G. 800,000 psi
H. 12,800 psi

Ans. D

The mass of a flywheel is 175 kg and its radius of gyration is 380 mm. Find the torque required to attain a speed of 500 rpm from rest in 30 seconds.

E. 40.46 N
F. 44.12 N
G. 35.66 N
H. 38.48 N

Ans. B

A steel bar 24 in. in length is to withstand a tensile impact load caused by a weight of 100 lb having a velocity on impact of 140 fpm. Find the stress in the bar if the diameter is 1 ½ in and the modulus of Elasticity (E) is $30x10^{6}$ psi.

Ans. S=12,000 psi

The cylinder head of a 10in x 18in. freon compressor is attached by 10 stud bolts made of SAE grade 5. The cylinder pressure is 300 psi. What is the approximate tightening torque should be used to induce a tightening stress (St) of 0.90 times the proof stress if the diameter of the bolt is 5/8 in and coefficient of collar friction c = 0.2?

Ans. T = 2161 in-lb

Calculate the power consumed during cutting of a low carbon steel bar 40 mm diameter if cutting force is 150 kg at 200 rpm.

E. 0.46 hp
F. 0.66 hp
G. 0.75 hp
H. 0.83 hp

Ans. D

A broach is used to cut a key way 8mm wide, 5mmm deep in a boss 64mm long. Determine the cutting length of broach if the rise per tooth is 0.0875mm and the number of finishing teeth is 13.

E. 672 mm
F. 627 mm
G. 762 mm
H. 726 mm

Ans. C

Calculate the power of electric motor for a drilling machine to drill a hole 15 mm diameter in cast iron workpiece at 450 rpm and 0.2 mm feed. The specific power is 0.03 kW and efficiency of motor is 80%.

E. 0.6 kW
F. 0.9 kW
G. 0.7 kW
H. 0.4 kW

Ans. A

A double square thread screw is used to raise a load of 20,000 lb at a velocity of 3 fpm. Outside diameter of thread and pitch are 2 7/8 in. and 1 in. respectively. Collar friction coefficient is 0.12, thread friction coefficient is 0.10. Mean diameter of collar 5 in. Determine the power required to drive the screw.

E. 3.45 hp
F. 4.29 hp
G. 4.65 hp
H. 5.02 hp

Ans. B

Two 2 ¾ in sellers standard square thread screws are used to raise and lower a hydraulic gate weighing 60 tons. A 570 rpm electric motor operates the screws. The coefficients of collar and thread friction are 0.03 and 0.14 respectively. The mean diameter of the collar 4in. if the gate rises at the rate of 2fpm, determine the size of the motor required to lift the gate if the mechanical efficiency is 85% for the speed reducing equipment.

E. 20 hp
F. 30 hp
G. 34 hp
H. 24 hp

Ans. C

A crate weighing 4,000 lb is moving at a speed of 4ft/s. It is brought to rest by two compression spring in stopping the crate, the springs are to be compressed 8 in. If the spring index is 6 and the allowable stress is 52,000 psi, determine the maximum load on each springs.

E. 1491 lbs
F. 2037 lbs
G. 1675 lbs
H. 2453 lbs

Ans. A

What describes very rough grinding such as that performed in foundries to remove gates, fins and risers from castings?

E. Snagging
F. Honing
G. Lapping
H. Snugging

Ans. A

Which of the following is a single measure that combines the external dynamic load of an application with a gear drive’s reliability and operating life?

E. Ratio factor
F. Service factor
G. Reliability factor
H. Life factor

Ans. C

What is the term used to described the distance from a point on one gear to the corresponding point measures along the base circle.

E. Diametral Pitch
F. Circular Pitch
G. Normal Pitch
H. Chordal pitch

Ans. C

Which of the following is the best method used for increasing a spring's fatigue life?

E. Sprickling
F. Shot peening
G. Stress relieving
H. Shot relieving

Ans. B

What is the term applied to parallel forces equal in magnitude but opposite direction?

E. Concurrent forces
F. Non-concurrent forces
G. Couple
H. Equillibrant

Ans. C

It is one of the rigid members / bodies joined together to form a kinematic chain.

E. Coplanar
F. Link
G. Frame
H. Machine

Ans. B

The kinematics chain in which one link is considered fixed for the purpose of analysis but motion is possible in other links.

E. Belting
F. Mechanism
G. Frame
H. Sprocket Chain

Ans. C

What describes very rough grinding, such as that performed in foundries to remove gates, fins and risers from castings?

E. Snagging
F. Honing
G. Lapping
H. Snugging

Ans. A

17. A carbide milling cutter 250 mm in diameter is used to cut a block mild steel with a plain cutter. The block is 500 mm long. If the feed is 0.50 mm/rev and depth of cut is 1.2 mm, determine the time required to take one cut. The over travel is 16 mm. the cutting speed is 80 m/min.

    e. 8.45 min
    f. 7.45 min
    g. 9.45 min
    h. 10.45 min

    Ans: D

18. The feed of an 8 tooth face mill cutter is 0.325 mm per tooth at 200 rpm. The material cut is 300 BHN steel. If the depth of cut is 3 mm and width is 100 mm, calculate the power at the cutter.

    e. 10.24 hp
    f. 12.48 hp
    g. 11.62 hp
    h. 13.22 hp

    Ans: B

19. Determine the power required for milling a mild steel work piece with a cutter of 80 mm diameter 9 teeth and rotating at 120 rpm. The work piece has a width of 60 mm. depth of cut is 4 mm and tooth load is 0.03 mm

    e. 1.2 kW
    f. 2.3 kW
    g. 1.9 kW
    h. 2.6 kW

    Ans: C

20. A leather belt 6 inches by ¼ in. thick running at 4000 ft/min. connects 12 in and 60 in. in diameter pulleys. The angles of contact are 270 deg. And 240 deg for small and large pulleys respectively. Coefficient of friction on large pulley is 0.4 on small pulley 0.3. if the allowable tension is 100 lb per in. determine the maximum horsepower that can be transmitted without considering centrifugal force.

    e. 44 hp
    f. 55 hp
    g. 33 hp
    h. 66 hp

    Ans: B

21. Determine the time required to turn a brass component 50 mm diameter and 100 mm long at a cutting speed of 36 m/min. the feed is 0.4 and only one cut is taken.

    e. 2.2 min
    f. 3.3 min
    g. 1.2 min
    h. 4.4 min

    Ans. C

22. A tool will cut for 4 hrs before it needs sharpening. Determine the time charged to one cycle if it takes 12 minutes to change the tool can be sharpened 10 times before it is discarded.

    e. 62 m/min
    f. 82 m/min
    g. 72 m/min
    h. 52 m/min

    Ans. B

23. Which of the following simple mechanical machine with the ability to increase an applied force?

    e. Hinges
    f. Lever
    g. Roller
    h. Spring

    Ans: B

24. Which of the following devices that is mainly used to raise or lower an object?

    e. Hoist
    f. Lever
    g. Spring
    h. Roller

    Ans: A

25. What is term applied to the process of separating different sizes of the same material?

    A. Screening
    B. Separation
    C. Sieving
    D. Screening

    Ans:C

    It is the process of separating a material into a variety of specifically sized groups.

    a. Centrifugal
    b. Fractioning
    c. Sieving
    d. Screening

    Ans: B

It is process in which metal is dropped in dilute acid solutions to remove dirt, grease, and oxides.
a. Pickling
b. Polishing
c. Sheradizing
D. Pakerizing
Ans: A

Which of the following mechanism is used to change the direction of an applied tensile force?
a. Gears
b. Pulleys
c. Flywheels
d. Ropes
Ans: B

What is usually the lose factor for most wire ropes and chains with 180° contact at low speeds?
A. varies from 1.03 to 1.06
B. varies 1.07 to 1.10
C. varies from 1.20 to 1.50
D. varies from 1.60 to 1.80
Ans: A

Which of the following is the method to determine the reactions on continuous beams?
a. two-moment equations
b. Second moment equations
c. three-moment equations
d. third moment equations
Ans: C

A machine component of mass 0.77 kg moves with simple harmonic motion in a straight line and completes 175 oscillations per minute. Find the accelerating force when the component is 50 mm from mid-travel.
a. 11.65 N
b. 12.93 N
c. 10.44 N
d. 13.22 N
Ans: B

What load in Newton must be applied to a 25 mm round steel bar 3.0 m long to stretch the bar 1.3 mm?
a. 42,056
b. 52,840
c. 55,016
d. 44,031
Ans: D

17. In the LRT II project steel railroad rails of 10 meters long are to be installed. If lowest temperature considered is 20 deg. C and a maximum temperature of 36 deg C is designed for, and the modulus of elasticity of steel to be 207,000 Mpa, determine the clearance between the clearance between rails such that adjoining rail will just touch at maximum design temperature.
a. 2.34
b. 3.32
c. 3.41
d. 1.86
Ans: D

18. What pressure is required to punch a hole 3 in. diameter through a ¼ in. steel plate?
a. 45 tons
b. 20 tons
c. 30 tons
d. 40 tons
Ans: A

19. A steel tie rod on bridge must be made to withstand a pull of 6,000 lbs. find the diameter of the rod assuming a factor of safety of 5 and ultimate stress of 64,000 psi.
a. 0.705 in
b. 0.891 in
c. 0.809 in
d. 0.773 in
Ans: D

20. An engine parts is being tested with a load of 30,000 lb. the allowable tensile stress is 10,000 psi, modulus of elasticity of 40×10^{6} psi. If the original length of specimen is 42 inches with elongation not exceeding 0.0015 inch, what diameter of the specimen is required?
a. 4.2 in
b. 3.0 in
c. 2.5 in
d. 5.17 in
Ans: D

21. A steel rod 75 inches long tested with a load of 3000 lb is suspended from the other end. If the rod stretches 0.025 inches, find the modulus of elasticity of the steel.
a. 36×10^{6} psi
b. 11.5×10^{6} psi
c. 30×10^{6}psi
d. 27×10^{6} psi
Ans: A

22. Considered is 20 deg C and a maximum temperature of 30 deg C is designed for, and the modulus of elasticity of steel to be 207,000 Mpa, determine the clearance between rails such that adjoining rail will just touch at maximum design temperature.
a. 2.34
b. 2.32
c. 3.41
d. 1.86
Ans: D

23. What pressure is required to punch a hole 3 in. diameter through a ¼ in. steel plate?
a. 45 tons
b. 20 tons
c. 30 tons
d. 40 tons
Ans: A

24. In practice and theory as well, what is the allowed permissible misalignment in cylindrical and tapered roller bearings?
a. 0.005 rad
b. 0.006 rad
c. 0.001 rad
d. 0.003 rad
Ans: C

25. In practice and theory as well, the misalignment of spherical bearings should not exceed how many radians?
a. 0.0087 rad
b. 0.0065 rad
c. 0.0041 rad
d. 0.0043 rad
Ans: A

26. What term is used to describe a maximum load that a bolt can withstand without acquiring a permanent set?
a. Live load
b. Dead load
c. Proof load
d. Ultimate load
Ans: C

27. In bolts design, the quotient of the proof load and the tensile-stress area is called
a. proof strength
b. yield strength
c. section modulus
d. modulus of resilience
Ans: A

28. In bolts design, proof strength corresponds approximately how many percent of the 0.2 percent offset yield strength?
a. 85%
b. 95%
c. 90%
d. 45%
Ans: C

29. What type of brass that is usually used to form tubing or piping to carry hot water in such application of radiators or condenser?
a. Red brass
b. Commercial brass
c. Yellow brass
d. Cartridge brass
Ans: A

30. It is in widespread use for the numbering system for cast iron by ASTM (American Society for Testing and Material), then this system is based on which of the following?
a. Bearing Strength
b. Compressive Strength
c. Axial Strength
d. Tensile Strength
Ans: D

31. It casting, brass, bronze, steel, gray iron and aluminum are most often used materials. What is the minimum wall thickness for of the aforementioned materials used in casting?
a. 5mm
b. 10mm
c. 7 mm
d. 3 mm
Ans: A

32. A rectangular key was used in a pulley connected to a line shaft with a power of 8 kw at a speed pf 1200 rpm. If the shearing stress of the shaft and key are 30 N/mm^2. Respectively. What is the diameter of the shaft?
a. 22.2 mm
b. 21.7 mm
c. 25.8 mm
d. 30.2 mm
Ans.A

33. A line shaft with a power of 150 KW at a speed of 1200 rpm, had a rectangular key used in its pulley connection. Consider the shearing of stress of the shaft to be 40 N/mm^2 and the key to be 200 N/mm^2, determine the shaft diameter.
a.66.62 mm
b.53.31 mm
c.40.82mm
d.44.94 mm
Ans. B

35. A cylinder having an internal diameter of 20 in and an external diameter of 36 in is subjected to an internal pressure of 10,000 psi and an external pressure of 2,500 psi. Determine the hoop stress at the inner surface of the cylinder.
a. 24, 705.16 psi
b. 19, 028.52 psi
c. 13, 142.86 psi
d. 11, 696.43 psi
Ans. D.

36. A thin walled cylindrical pressure vessel is subjected to internal pressure which varies from 750 kPa to 3350 kPa continuously. The diameter of the shell is 150 cm. Find the required thickness of the cylinder based on yield point of 480 MPa net endurance limit of 205 MPa and a factor of safety of 2.5.
a. 21.2 mm
b. 22.21 mm
c. 23.83 mm
d. 20.72 mm
Ans. A

37. A compression ring is to be used at the junction of a conical head and shell. Determine the required area of the compression ring if the pressure is 50 psi and the stress is 13750 psi. Assume efficiency of the joint is 80%.
a. 0.00715 d^2
b. 0.00482 d^2
c. 0.00712 d^2
d. 0.00682 d^2
Ans. A

38. A cylindrical vessel measuring (2ft x 5 ft) holds a gas at 3,000 psi. Using stainless OQT 12000, determine the thickness of the plate with a design factor of 1.4 yield. A assume efficiency of welded joint as 85%.
a. 0.549 in
b. 0.455 in
c. 1.2 in
d. 0.3 in
Ans. A

39. Which of the following is considered to be the lightest of all commercial metals and is used in aircraft industry?
a. titanium
b. chromium
c. magnesium
d. aluminum
Ans. C

40. Brass with 40% zinc are called ___
a. muntz metal
b. bronze
c. yellow brass

d. admiralty metal
Ans. A

41. How do you call a brass that contains 28% zinc, 1 % tin and very excellent corrosion resistance especially in saltwater.
a. muntz metal
b. bronze
c. yellow brass
d. admiralty metal

42. A brass with 40% zinc or same composition as muntz metal expect for the addition of 0.75% tin that contributes to the corrosion resistance of this material.
a. naval brass
b. bronze
c. cartridge brass
d. admiralty metal
Ans. A

43. High pressure vessels and pipes carrying high pressure fluids develop which of the following stresses?
a. tangential stress only
b. radial stress only
c. bearing stress only
d. both radial and tangential stress
Ans. C

44. For the rotating elements like flywheels and blowers, the analysis of stresses will be based similar on which of the following theory?
a. thin-walled cylinder
b. thick- walled cylinder
c. radial ball bearing
d. rotating shaft member
Ans. B

45. For thin-walled pressure vessels, which of the following statements is correct of the stresses?
a. Radial stresses is quite small as compared with the tangential stress.
b. Radial stresses is quite bigger as compared with the tangential stress.
c. Radial stresses is same as tangential stress.
d. Only radial stress is present and no tangential stress.
Ans. A

46. How do you call the ratio of lateral strain to longitudinal strain?
a. Poission’s ratio
b. Modulus of resilience
c. Modulus of rigidity
d. Offset ratio
Ans. A

47. A sheet metal working company purchase a shearing machine from a surplus dealer without a flywheel. It is calculated that the machine will use 2380 Joules of energy to shear a 1.2 mm thick sheet metal. The flywheel to be used will have a mean diameter of 91.44 cm with a width of 25.4 cm. The normal operating speed is 180 rpm and slows down to 160 rpm during the shearing process. Assuming that the arms and the hub will account for 12 % of the rim weight concentrated at the mean diameter and that the material density is 0.26 lb/cu/ in, compute for the weight of the flywheel.
a. 296 kg
b. 306 kg
c. 347 kg
d. 385 kg

48. A 48 in diameter spoked steel flywheel having a 12 in wide x 10 in deep rim rotates at 200 rpm. How long a cut (in inches) can be stamped in one inch thick aluminum plate if ultimate shearing strength of the aluminum is 40,000 lb/in2. During stamping , the force exerted by the stamp varies from a maximum F lb at the point of contact to zero lb when the stamp emerges from the metal. Neglect the weight of the flywheel weight of the flywheel and spokes and use 0.28 lb/in3 density for flywheel material.
a. 43.2 in
b. 41.1 in
c. 44.5 in
d. 35.9 in
Ans. B

49. A shearing machine requires 150 kg m of energy to shear a steel sheet, and has normal speed of 3.0 rev/sec slowing down to 2.8 rev/sec during the shearing process. The flywheel account for 15% of its total weight, find the thickness of the rim in cm.
a. 0.00487 cm
b. 0.00432 cm
c. 0.00363 cm
d. 0.00482 cm
Ans. C

50. In a shearing machine the energy is 29,264 ft-lb, the ultimate shearing stress of the steel plate is 40,000 psi, the plate thickness is 1 inch the length of the plate which can be sheared is:
a. 7055 in
b. 10.55 in
c. 12.75 in
d. 17.56 in

51. What would be the weight of a flywheel in kg if the weight of the rim is 3 times the sum of the weight of the hub and arms. Given the outside diameter and inside diameter to be 24 in and 18 in respectively and the rim width is 4.5 in. (assume steel flywheel)
a. 140.95 kg
b. 160.95 kg
c. 200.95 kg
d. 152.95 kg
Ans. D

52. A cast iron flywheel with a mean diameter of 36 inches changes speed from 300 rpm to 280 while it gives up 8000 ft-lb of energy. What is the coefficient of fluctuation?

a. 0.069
b. 0.015
c. 0.082
d. 0.020
Ans. A

53. Which of the following processes usually used to create a bar of material of a particular shape and dimensions?
a. extrusion
b. cold working
c. forging
d. hot rolling
Ans. D

54. The G10400 is a plain carbon steel with steel with a carbon content of which of the following?
a. 0.37 to 0.44%
b. 0.21 to 0.54%

c. 0.25 to 0.57%
d. 0.34 to 0.54%
Ans. A

55. The S30200 is usually called and 18-8 stainless steel, which means 18% of what?
a. chromium
b. nickel
c. carbon
d. manganese
Ans. A

56. Which of the following terms is used to descry punch-pressed operations like forming, blanking shallow drawing and coining?
a. stamping
b. heading
c. roll treading
d. spinning
Ans. A

57. Which of the following processes produce a refined grain structure and eventually increased strength and ductility of the material?
a. Extrusion
b. Cold working
c. Forging
d. Hot rolling
Ans. C

58. The S30200 is usually called and 18-8 stainless steel, which means 8% of what?
a. Chromium
b. Nickel
c. Carbon
d. Manganese
Ans. B

59. It is a supersaturated solid solution of carbon in ferrite and it the hardest and strongest form of steel?
a. Bainite
b. Ferrite
c. Martensite
d. Lignite
Ans. C

60. An ammonia compressor is driven by a 20kW motor. The compressor and the motor RPM are 380 and 1750, respectively. The small sheave has a pitch diameter of 152.4 mm. If the bolt to be used is standard C-120 (L=122.9in.). Determine the center distance between sheaves
D. 709 mm
E. 865 mm
F. 806 mm
G. 686 mm
Ans. C

61. A safety valve spring having 9 and ½ coils has the ends squared and ground. The outside diameter of the coil is 115 mm and the wire is 13 mm. It has a free length of 203 mm. Determine the length of the wire to which this spring must be initially compressed to hold a boiler pressure of 1.38 MPa on the seat of 32 mm diameter. Modulus of rigidity is taken as $G=80GN/m^2$.
I. 172
J. 179
K. 192
L. 158
Ans. A

62. A single threaded trapezoidal metric thread has a pitch of 4 mm, and a mean diameter of 18 mm. It is used as a translation screw in conjunction with a collar having an outside diameter of 37 mm and an inside diameter of 27 mm. Find the required torque in N-m to raise a load of 400 kg if the coefficient of friction is 0.3 for both thread and collar.
I. 34.6 N-m
J. 32.6 N-m
K. 39.1 N-m
L. 38.5 N-m
Ans. B

63. Determine the diameter of the stud bolt that are required to fasten down the cylinder head of a 203 mm x 304 mm gas engine. There are ten bolts on the block. The explosion pressure is 31 kg/sq.cm and studs are made of ordinary bolts material SAE 1020. How deep should the bolt be drilled?
I. 38.1 mm
J. 40.2 mm
K. 37.3 mm
L. 35.5 mm
Ans. A

64. A single square thread power screw is to raise a load of 70 kN. The screw has a major diameter of 36 mm and a pitch of 6 mm. The coefficient of thread friction and collar friction are 0.13 and 0.10 respectively. If the collar mean diameter is 90 mm and the screw turns at 60rpm, find the combined efficiency of screw and collar.
I. 13.438%
J. 15.530%
K. 14.526%
L. 12.526%
Ans. D

65. Find the horsepower required to drive a power screw lifting a load of 4000 lbs. A 2 and ½ inches double square thread with two threads/in is to be used. The friction radius of the collar is 2 inches and the coefficients of friction are 0.1 for the threads and 0.15 for the collar. The velocity of the nut is 10 ft/min.
I. 5.382 HP
J. 4.395 HP
K. 3.683 HP
L. 6.472 HP
Ans. B

66. A flywheel has a mean diameter of 4 ft and is required to handle 2200 ft-lb of kinetic energy. The flywheel has a width of 8in. Normal operating speed is 300 rpm and the coefficient of fluctuation is to be 0.05. Find the weight of the rim assuming that the arms and hub are equivalent is 10% of the specific weight.
I. 412 lb
J. 334 lb
K. 452.4 lb
L. 533 lb
Ans. B

67. Find the rim thickness for a cast iron flywheel with a width of 200 mm, a mean diameter of 1.2 in a normal operating speed of 300 rpm, a coefficient fluctuation of 0.05 and which is capable of hanging 3000 N-m of kinetic energy. Assume that the hub and arms represent 10% of the rim weight and the specific weight of cast iron is 7200 kg/m^3
I. 25.28 mm
J. 28.82 mm
K. 28.25 mm
L. 25.25 mm
Ans. C

68. A cast iron flywheel is rotated at a speed of 1200 rpm and having a mean rim radius of 1 foot. If

the weight of the rim is 30 lbs. What is the centrifugal force? Use factor C=41.
I. 14,800 lbs
J. 70,000 lbs
K. 14 860 lbs
L. 14,760 lbs
Ans. D

69. The maximum-strain theory which apples only in elastic range of stresses are also known as _____

I. Hooke's Law
J. Saint Venant's Theory
K. Stress-strain Theory
L. Cataligno's Theory
Ans. B

70. It refers to the collision of two or more masses with initial velocities.
I. Shock
J. Impact
K. Creep
L. Load
Ans. B

71. A term used to describe sudden applied force or disturbance.
I. Shock
J. Impact
K. Creep
L. Load
Ans. A

72. A cone-disk spring is also known as _____
I. Believille Spring
J. Heavy duty spring
K. Helical spring
L. Conical spring
Ans. A

73. What is the other term used for die casting?
I. Thermosetting
J. Shell-molding
K. Metal-mold casting
L. Tangential casting
Ans. C

74. It is a cold-working process in which metal is gathered or upset.
I. Heading
J. Cold rolling
K. Spinning
L. Stamping
Ans. A

75. Which of the following is the high-leaded brass used for instrument, lock and watch parts?
I. Red brass
J. Commercial brass
K. Yellow brass
L. Engraver's brass
Ans. D

76. The rapid cooling of steel to a temperature between 400 to 800 deg F in enough time, then austenite is transformed into a materials called.
I. Bainite
J. Lignite
K. Quinite
L. Ferrite
Ans. A

77. A centrifugal pump is directly couple to a motor. The pump rating is 3,600 liters per minute against a total head of 8 meters of water. Pump efficiency is 65% at shaft speed of 550 rpm. Calculate the torsional stress induced on the 40 mm diameter motor shaft.
I. 11,193.45 kPa
J. 12,420.72 kPa
K. 10,010.85 kPa
L. 13,113.83 kPa
Ans. C

78. A 80 mm solid shaft is to be replaced with a hallow shaft of equal torsional strength. Find percentage of weight saved, if the outside of the hallow shaft is 100 mm.
I. 56.53%
J. 67.31%
K. 48.49%
L. 52.90%
Ans. D

79. A solid transmission shaft is 4.0 inches in diameter. It is desired to replace it with a hallow shaft of the same material and same torsional strength but its weight should only be half as much as the solid shaft. Find the outside diameter of the hallow shaft in millimeters.
I. 107.315 mm
J. 112.231 mm
K. 122.940 mm
L. 131.204 mm
Ans. C

80. A railroad track is laid at a temperature of 10 degree F with gaps of 0.01 feet between the ends of the rails. The rails are 33 feet long. If they are prevented from buckling, what stress will result from a temperature of 110 degree F? Coefficient of linear expansion = $6.5x10^{n}$ per degree F.
I. 10,000 psi
J. 8,530 psi
K. 9,450 psi
L. 10409 psi
Ans. D

81. What load P which causea total deformation of 0.036 inch of a steel rack which has a cross-section area of 4 sq. inches and a length of 5 ft.
I. 55,000 lb
J. 72,000 lb
K. 60,000 lb
L. 50,000 lb
Ans. B

82. A lubrication where lubricant is introduced between surfaces which are in rolling contact such as roller gears or rolling bearings?
I. Hydrostatic lubrication
J. Hydrodynamic lubrication
K. Elastohydrodynamic lubrication
L. Solid-film lubrication
Ans. C

83. What lubrication is usually used when bearings are operating at extreme temperatures?
I. Hydrodynamic lubrication
J. Solid-film lubrication
K. Hydrostatic lubrication
L. Liquid-film lubrication
Ans. B

84. Which of the following is not a form of bearing lubrication?
I. Liquid-film lubrication
J. Hydrodynamic lubrication
K. Hydrostatic lubrication
L. Solid-film lubrication
Ans. A

85. In ASTM standard, what is the instrument used in determining viscosity?
I. Dynamic viscometer
J. Saybolt universal furol
K. Hagen-Poinsulle viscometer
L. Saybolt universe viscometer
Ans. D

86. In what country that the present theory of hydrodynamic lubrication originates from?
I. China
J. Germany
K. US
L. England
Ans. D

87. In viscosity chart, Raimond-Boyd analysis assumed that the viscosity of the lubricant is _____
I. Constant
J. Increasing
K. Decreasing
L. Vanishing
Ans. A

88. What do you call the phenomenon occurring when two touching surfaces have a high contact pressure and when these surfaces have minute relative motion?
I. Prestressing
J. Friction
K. Fretting
L. Carving
Ans. C

89. What type of bolt threaded on both ends and can be used where a through bolt impossible?
I. Coupling
J. Stud bolt
K. Carriage bolt
L. Machine bolt
Ans. B

90. What type of bolt distinguished by a short potion of the shank underneath the head being square or finned or ribbed?
I. Coupling
J. Stud bolt
K. Carriage bolt
L. Machine bolt
Ans. C

91. What is the term applied to the reciprocal of the velocity ratio?
I. Train value
J. Modular value
K. Ratio factor
L. None of these
Ans. A

92. For very slender column, what type of formula that is best applied?
I. Column formula
J. Moment formulas
K. Slenderness formulas
L. Euler formula
Ans. A

93. Which of the following is the type of failure due to unstability?
I. Buckling
J. Stability
K. Slenderness formulas
L. Euler formula
Ans. A

94. What type of spring made in the form of dished washer?
I. Air spring
J. Volute spring
K. Believille spring
L. Motor spring
Ans. C

What is the minimum number of teeth on a smaller sprocket for high speed?
I. 12
J. 21
K. 24
L. 14
Ans. B

Which of the following is the minimum number of teeth on a smaller sprocket for moderate speed?
I. 15
J. 12
K. 21
L. 17
Ans. D

What is the minimum number of teeth on a smaller sprocket for low speed?
I. 11
J. 17
K. 21
L. 12
Ans. 12

Two shaft at right angles to each other may be connected by what arrangement?
I. Half turn
J. ¾ turn
K. Quarter turn
L. One turn
Ans. C

What is the recommended initial tension of the belt?
I. 75 lb/in of width
J. 71 lb/in of width
K. 73 lb/in of width
L. 80 lb/in of width
Ans. A

What factor of safety is needed for a 2 in. diameter shaft with an ultimate strength of 50,000 psi to transmit 40,000 in-lb torque.
I. 2.25
J. 1.95
K. 2.14
L. 2.62
Ans. D

A round steel shaft transmits 373 watts at 1800 rpm. The torsional deflection is not to exceed 1 deg in a length equal to 20 diameters. Find the shaft diameter.
I. 6.53 mm
J. 8.72 mm
K. 12.84 mm
L. 18.16 mm
Ans. A

A steel shaft operates at 186 rad/s and must handle 2 kW of power. The shearing stress is not to exceed 40 MN/m². Calculate the minimum shaft diameter based on pure torsion.

I. 9 mm
J. 11 mm
K. 13 mm
L. 15 mm
Ans. B

A 100 mm diameter solid shaft is to be replaced with a hollow shaft equally strong (torsion) and made of the same material. The outside diameter of the hollow shaft is to 27 mm. What should be the inside diameter? The allowable shearing stress is 41.4 MPa?
I. 107.42 mm
J. 105.82 mm
K. 291.53 mm
L. 109.60 mmw
Ans. A

If the weight of 6″ diameter by 48″ long SAE 1030 shafting is 174.5 kg then what will be the weight of chromium SAE 51416 of same size?
I. 305.79 lbs
J. 426.70 lbs
K. 347.96 lbs
L. 465.89 lbs
Ans. C

A 50 inches diameter diamond saw blade is mounted on a pulley driven steel shaft, required a blade peripheral linear speed of 150 ft/sec. Motor drive is 125 hp at 1,200 rpm, with 6 inches diameter pulley. Determine the shaft rpm to attain blade peripheral speed required.
I. 716.2 rpm
J. 635.3 rpm
K. 539.10 rpm
L. 687.55 rpm
Ans. D

A steel shaft transmits 40 hp at 1400 rpm. Considering allowable shearing stress based on pure torsion to be 5000 psi, find the torsional deflection of the shaft in degrees per foot.
I. 0.392 degrees/foot
J. 0.246 degrees/foot
K. 0.541 degrees/foot
L. 0.435 degree/foot
Ans. B

The process by which high pressure is applied to a heated metal billet or blank which causes it to flow through restricted orifice.
I. Extrusion
J. Intrusion
K. Forging
L. Hot rolling
Ans. A

A tolerance where the size of a part is permitted to be either larger or smaller than the given dimension.
I. Bilateral
J. Unilateral
K. Lateral
L. None of these
Ans. A

In a pressure vessel, the ratio of minimum strength of joint to the strength of solid joint is known as
I. Efficiency
J. Performance factor
K. Joint efficiency
L. Relative strength
Ans. D

When tested in compression, ductile material usually exhibit_____ characteristics up to the yield strength as they do when tested in tension.
a. the same
b. less than
c. more than
d. approximately the same
ans. D

In pure torsion, the maximum stress is at the center of the
a. peripheral sides
b. long sides
c. medium sides
d. short sides
ans: B

The ability of a material to absorb energy within is proportional limit is known as
a. resilience
b. endurance
c. toughness
d. spring action
ans: A

A method whereby a gear is run with another gear that has abrasive surface material.
a. hobbing
b. honing
c. lapping
d. milling
ans. C

A multiple disc clutch of 10 steel disc and 9 bronze disc. the effective outside and inside diameter are 20.32 cm and 15.24 cm, respectively if the axial force of 450 Newton is applied and the shaft turns at 1200 rpm, find the horsepower capacity, assume a coefficient of friction of 0.27.
a. 39.566 hp
b. 40.482 hp
c. 37.456 hp
d. 35. 659 hp
Ans: A

An engine of a motor vehicle with a wheel diameter of 712 mm develops 50 kW at 2,000 rpm. the combined efficiency of the differential and tranmission is 75% with an overall speed reduction of 25 is to 1. Determine the speed reduction of travel of the vehicle in km/hr.
a. 10.74
b. 11.69
c. 12.58
d. 13.80
Ans: A

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a. 10.74
b. 11.69
c. 12.58
d. 13.80
Ans. A

An engine of a motor vehicle with a wheel diameter of 712 mm develops 50 kW at 2,000 rpm combined efficiency of the differential and transmission is 75% with an over-all speed reduction to. 1 determine he torque to be delivered by the clutch N-m.
a. 239 N-m
b. 359 N-m
c. 432 N-m
d. 471 N-m

Ans: A

The large diamter and face of the disk of a multiple disk clutch are 255 mm and 25 mm respectively the helical compression spring used to engage the clutch has 9 and 1/2 effective coils of 10 mm steel wire. the outer coil diameter is 80 mm. the free length of the spring is 185 mm. when in place with clutch engaged, its length is 130 mm. Assuming that there is 10 pairs of friction surface in contact, that the motor runs at 1200 rpm, f=0.15, determine axial force available for the clutch.
a. 1,688 N
b. 2,493 N
c. 1,542 N
d. 2,783 N
Ans: A

A flange bolt coupling consist of eight steel 20 mm diameter steel bolts spaced evenly around a bolt circle 300 mm in diamter. if the coupling is subjected to a torque of 15.1 KN-m, determine the maximum shearing stress in the bolts?
a. 40450 kPa
b. 63320 kpa
c. 40054 kpa
d. 31298 kpa
Ans: C

a flange coupling is to be designed, using 25 mm diameter bolts at a distance of 152 mm from the center of the shaft. allowable shearing stress on the bolt is 103 Mpa. if the shaft is to transmit 5,600 hp at a speed of 1200 rpm, how many bolts are needed in the connection?
a. 2
b. 3
c. 4
d. 5
Ans: D.

Two short shaft identical diameter 38.1 mm and rotating ….
e. 30.4 kW
f. 28.5 kW
g. 29.3 kW
h. 32.3 kW
Ans:B

Two short shaft identical diameter 38.1 mm and rotating ….
e. 19.30 mm
f. 22.37 mm
g. 20.40 mm
h. 16.32 mm
Ans: D

What is material is produced if austenite is cooled rapidly to 400 deg. F or less?
e. Bainite
f. Fermite
g. Martensite
h. Lignite
Ans: C

Stainless steels are iron-based alloys that contain at least how many percent chromium?
e. 45%
f. 25%
g. 12%
h. 5%
Ans: C

The very high carbon steels have good quench-harden ability up to how many percent chromium?
e. 35%
f. 12%
g. 18%
h. 15%
Ans: C

A widely used in tool steels considering that the will maintain its hardness even it is red heat. The effect is like molybdenum, except it is to be added in greater quantities.
e. Vanadium
f. Manganese
g. Tungsten
h. Nickel
Ans: C

Which of the following is the most widely used cast materials?
e. White cast iron
f. Gray cast iron
g. Malleable cast iron
h. Nodular cast iron
Ans: B

What is the result if all the carbon in cast iron is in the form of cementite and pearlite with not graphite present?
e. White
f. Gray
g. Malleable
h. Nodular
Ans: A

Which of the following is a characteristic of aluminium and its alloys?
e. Resistance to corrosion
f. High thermal and electrical resistance
g. Strength to weight ratio
h. All of these
Ans: D

The corrosion resistance of aluminium alloys depends upon which of the following?
e. Thin coating oxide
f. Percentage of electrolyte present
g. Dissolve ferrite
h. Casting of the material
Ans: A

A spherical shell of 1.8 m of outside diameter and 1.725 m inside at a pressure of 10.4 MPa. Compute the stress in the shell.
e. 124.8 Mpa
f. 119.6 Mpa
g. 96.48 Mpa
h. 88.46 Mpa
Ans: B

A thin hollow spheres of radius 10 in and thickness 0.1 in is subjected to an internal pressure of 100 psig the maximum normal stress on an element of the sphere is:
e. 5,000 psi
f. 7,070 psi
g. 14,140 psi
h. 2,500 psi
Ans: A

Pressurized water at 1.37 Mpa is stored in a steel cylindrical tank 1.4 meters in diameter. If the allowable tangential stress is 8.5 Mpa, find the required wall thickness of the tank.
e. 123.6 mm
f. 130.5 mm
g. 112.9 mm
h. 135.1 mm
Ans: A

A mechanical press is used to punch 6 holes per holes is 25 mm diameter and the plates has an ultimate strength in shear of 420 Mpa. The normal operating speed 200 rpm. And it slows down to 180 rpm during the process of punching. The flywheel has a mean diameter of one meter and the rim width is 3 times the thickness. Assume that the hub and arm account for 5% of the rim weight concentrated at the mean diameter and the density of cast iron is 7200 kg per cubic meter. Find the power in kW required to drive the press.

e. 1.310 kW
f. 5.57 kW
g. 8.92 kW
h. 9.03 kW
Ans: A

Find the weight of the flywheel needed by a machine to punched every stroke plane. The machine is to make 30 strokes per minute and a hole must be punched every stroke. The hole is to be formed during 30 degrees rotation of the puncher's crankshaft. A gear train with a ratio of 12 to 1 is to connect the flywheel shaft to the crankshaft. Let the mean diameter of a flywheel rim to be 91.44 cm. the minimum flywheel speed is to be 90% of the maximum and assume mechanical efficiency of the machine to be 80%. Assume an ultimate stress of 49000 psi.

e. 1.310 kW
f. 5.57 kW
g. 8.92 kW
h. 9.03 kW
Ans: A

Find the weight of the flywheel needed by a machine to punch 20.5 mm holes in 15.87 mm thick steel plate. The machine is to make 30 strokes per minute and a hole be punched every stroke, the hole is to be formed during 30 degrees rotation of the puncher crankshaft. A gear train with a ratio of 12 to 1 is to correct the flywheel shaft to the crankshaft. Let mean diameter of a flywheel rim to the 91.44 cm. the manimum flywheel speed is to be 90% of the maximum and assume mechanical efficiency of the machine to be 80% Assume an ultimate stress of 49000 psi.

e. 68 kg
f. 97 kg
g. 90 kg
h. 92 kg
Ans: B

It is found that the shearing machine requires 205 joules of energy to shear a specific gauge of sheet metal. The mean diameter of the flywheel is to be 76.2 cm. the normal operating speed is 200rpm and slow down to 180 rpm during shearing process. The rim width is 30.48 cm and the weight of cast iron is 7,196.6 kg/m^3, find the thickness of the rim, assuming that the hub and arm account for 10% of the rim weight concentrated on the mean diameter.

e. 0.583 cm
f. 0.587 cm
g. 0.672 cm
h. 0.480 cm
Ans: B

Which of the following cannot be a Poisson's ratio of material?

e. 0.35
f. 0.20
g. 0.57
h. 0.12
Ans: C

Type of roller bearing in which the balls are assembled by the eccentric displacement of the inner ring.

e. Shallow groove ball bearing
f. Self-alignning ball bearing
g. Fillinf-shot ball bearing
h. Deep-groove ball bearing
Ans: D

Which of the following is not a type of ball bearing?

e. Shallow groove ball bearing
f. Self-aligning ball bearing
g. Filling-slot ball bearing
h. Deep-groove ball bearing
Ans: A

Which of the following is the approximate density of the leather belt?

e. 0.025 lb/in^3
f. 0.035 lb/in^3
g. 0.0135 lb/in^3
h. 0.0465 lb/in^3
Ans: B

The breaking strength of oak-tanned beltings varies from 3 to more than:

e. 5 ksi
f. 7 ksi
g. 6 ksi
h. 9 ksi
Ans: C

Based on experience, what is the most economical design belt speed?

e. 6000 to 7500 fpm
f. 3500 to 4700 fpm
g. 3000 to 5000 fpm
h. 5000 to 1000 fpm
Ans: A

The tension in the belt due to centrifugal force increasing rapidly above about

e. 1500 fpm
f. 3500 fpm
g. 3000 fpm
h. 2500 fpm
Ans: D

What is the recommendation speed for leather belt?

e. 6000 to 7000 fpm
f. 7000 to 8000 fpm
g. 5000 to 6000 fpm
h. 4500 to 5600 fpm
Ans: B

What is the recommended speed for fabric belts?

e. 4000 to 5000 fpm
f. 2000 to 3000 fpm
g. 3000 to 4000 fpm
h. 2000 and more fpm
Ans: A

A tubular shaft, having an inner diameter of 30 mm and an outer diameter of 42 mm, is to be used to transmit 90 kW of power, determine the frequency of rotation of the shaft so that the shear stress cannot exceed 50 Mpa.

e. 26.6 Hz

f. 20.6 Hz
g. 97.5 Hz
h. 66.5 Hz
Ans: A

Two circular shaft, one hollow and one solid, are made of the same material and have diameter as follows: hollow shaft inside diameter is one-half of the external diameter. The external diameter is equal to the diameter of the solid shaft. What is the ratio of the twisting moment of the hollow shaft to that of the solid shaft?
e. ¼
f. ½
g. 9/16
h. 15/16
Ans: D

Determine the thickness of hollow shaft having an outside diameter of 100 mm if it is subjected to a maximum torque of 5,403.58 N-m without exceeding a shearing stress of 60 Mpa or a twist of 0.5 degree per meter length of shaft G=83,000 Mpa
e. 15 mm
f. 86 mm
g. 16.8 mm
h. 14.2 mm
Ans: A

A hollow shaft with outside diameter of 14 cm, and wall thickness of 0.8 cm, transmits 200 kW at 500 rpm. What must be the angular deflection of the shaft it the length in 5 meters? The material of the shaft is C4140 steel.
e. 21.41 rad
f. 21.71 rad
g. 36.80 rad
h. 17.37 rad
Ans. D

A 1 1/4 in by 7/8 in. key is to be designed for a 12.7 cm shaft which will transmit power of 150 KW at 360 rpm. If the allowable shear stress for the key is 920 kg/cm^2 and the allowable compressive stress is 1300 kg/cm^2. Determine the length of key to be used.
e. 2.41 cm
f. 2.73 cm
g. 4.42 cm
h. 4.79 cm
Ans. C

A pulley is keyed to a 2 and 1/2 inches diameter shaft by a 7/16 in x 3 in flat key. The shaft rotates at 50 rpm. The allowable compressive stress for the key, hub and shaft are 66 ksi. 59 ksi and 72 ksi, repectively. Determine the maximum torque the pulley can safety deliver.
e. 48398.4 in-lb
f. 54140.6 in-lb
g. 51562.5 in-lb
h. 67495.2 in-lb
Ans. A

Which of the following is the statement of how the total moment is derived from a number of forces acting simultaneously at a point?
e. Goodman’s theorem
f. Varignon’s theorem
g. Soderberg’s theorem
h. Cataligno’s theorem
Ans. B

It is the measure of the material’s ability to yield and absorb highly localized and rapidly applied stresses.
e. Hardness
f. Toughness
g. Stiffness
h. Resilience
Ans. B

What is term applied to the load at which a column fails?
e. Maximum load
f. Moving load
g. Critical load
h. Dynamic load
Ans. C

It is otherwise known as the percentage difference in solid and working deflections?
e. Clash allowance
f. Spring allowance
g. Working allowance
h. Thrust allowance
Ans. C

It is known as the shaft’s natural frequency of vibration.
e. Vibration index
f. Critical speed
g. High speed
h. Low speed
Ans. B

What do you call the mixture of the solid ingredients with no solubility?
e. Binary alloy
f. Miscible alloy
g. Bitectic material
h. Eutectic alloy
Ans. D

Which of the following terms applied to an interrupted quenching process resulting in an austenite to banite transition?
e. Austempering
f. Austenitizing
g. Martempering
h. Martenitizing
Ans. A

Which of the following processes where the material will become progressively stronger, harder and more brittle until eventually fails?
e. Hot working
f. Cold Working
g. Tempering
h. Normalizing
Ans. B

…. to engage the clutch?
e. 600 lbs
f. 715 lbs
g. 625 lbs
h. 800 lbs
Ans. B

A set screw 12 mm effective diameter is broken by a force of 410 N on the end of a spanner 300 mm long. Find the torque to break a set screw of 16 mm effective diameter if its breaking stress is 10% greater than the former.
e. 320.6 N-m
f. 223.5 N-m
g. 230.5 N-m

h. 345.6 N-m
Ans. A

A Warwick screw is used to tighten a guy rope. It has right-hand thread of 10 mm pitch at the top and a left-hand thread of 5 mm pitch at the bottom, and the effective radius of the toggle bar is 336 mm. Find the velocity.
e. 220.6
f. 130.5
g. 140.8
h. 210.5
Ans. C

A 4 inches diameter shaft is driven at 3600 rpm by a 400 Hp motor. The shaft drives a 48 inches diameter chain sprocket having an output efficiency of 85%. The output force of the driving sprocket and the output of the driven sprocket are:
I. 200 lb and 250 hp
J. 261.6 lb and 300 hp
K. 291.66 lb and 340 hp
L. None of the above
Ans. C

A certain farm equipment which requires 2200 Newton mater torque at 500 RPM has a diesel engine to operates at 1500 RPM as its prime mover. A No. 60 roller chain with a total length of 60 pitches and a small sprocket with 23 teeth are to be used with an operating temperature to remain constant at 45 degree C. Determine the no. of teeth of the larger sprocket.
I. 70
J. 69
K. 68
L. 69
Ans. D

A sleeve bearing has an outside diameter of 1.5 in and a length of 2 in, the wall thickness is 3/16 in. The bearing is subjected to a radial load of 450 lb. Find the bearing pressure.
I. 100 psi
J. 150 psi
K. 200 psi
L. 250 psi
Ans. C

Find the torsional deflection, in degrees of a solid steel shaft 110 mm OD 1.4 m long subjected to 3.1 x 10^{8} N-mm. The torsinal modulus of elasticity is 80,000 N/mm-mm
I. 0.22
J. 0.195
K. 0.28
L. 0.24
Ans. A

A cut gear transmits 25 Hp at a pitch line velocity of 6000 ft/min. If the service is intermittent the dynamic load is:
I. 244
J. 264
K. 274
L. 284
Ans. C

An internal gearing requires an idler gear if the driving gear of 6 inches in diameter and the center distance of the idler to the driver is 20 inches. What is the inside diameter of the driven gear?
I. 62
J. 70
K. 74
L. 81
Ans. C

In a standard bevel gear, the pinion rotates at 150 rpm, its number of teeth is 14 while the gear has 42 teeth, what is the pitch angle of the pinion?
I. 18.4 degrees
J. 20 degrees
K. 14.5 degrees
L. 20.5 degrees
Ans. A.

In damped free vibration, when the system returns to its static position with the …… equilibrium, the system is said to be
I. Underdamped
J. Overdamped
K. Resonant
L. Critically damped
Ans. D

Balancing o grinding wheel is done to
I. Make the outside diameter concentric with the bore
J. Make the sides of wheel parallel
K. Equalize the weight in every portion of the wheel
L. None of the above
Ans. C

A grinding wheel is marked as 51A 46L 5V 23, out of these 5 means
I. Kind of abrasive
J. Structure
K. Kind of bond
L. Grain size
Ans. B

It is also known as diamond pyramid hardness test, uses a pyramid shaped diamond indenter and a load that ranges from 1 kg to 120 kg.
I. Vickers test
J. Mohs hardness
K. Knoop test
L. Brinell test
Ans. A

The maximum moment induced in a simply supported beam of 20 foot span, by a 2,000 pound load at midspan is
I. 125,000 ft-lbs
J. 15,000 ft-lbs
K. 30,000 ft-lbs
L. 10,000 ft-lbs
Ans. D

A 10" diameter pulley is belt driven with a net torque of 250 ft-lbs. The ratio of tensions in the tight to stack sides of the belt is 4 to 1. What is the maximum tension in the belt?
I. 250 lbs.
J. 800 lbs.
K. 83 lbs.
L. 500 lbs.
Ans. B

Compute how many 3/8 inch diameter set screws required to transmit 3 Hp at a shaft speed of 1000 rpm. The shaft diameter is 1 inch
I. 1 ½
J. 2
K. 3
L. 1

Ans. B

A drop hammer of 1 ton dead weight capacity is propelled downward by a 12 inch diameter cylinder. At 100 psi air pressure what is the impact velocity if the stroke is 28 inches?
I. 47.4 ft/sec
J. 31.6 ft/sec
K. 15.8 ft/sec
L. 63.2 ft/sec
Ans. B

A link has a load factor of 0.8 the surface factor 0.8, the surface factor is 0.92 and the endurance strength is 28000 psi. Compute the alternating stress of the link if it is subjected to a reversing load. Assume a factor of safety of 3.

I. 8150
J. 10920
K. 9,333
L. 7260
Ans. C

Determine the average time to cut by automatic oxy-acetylene (machine) crosswise a 4ft x 8ft x 4in thick steel plate.
I. 6.85 min.
J. 318 sec
K. 10 min
L. 360 sec
Ans. D

A 16 mm plate is lapped over and secured by fillet weld on the inside and outside to form a penstock 1.5 meter in diameter. Determine the safe internal pressure, assuming an allowable stress of 140 MPa on the plate and an allowable shear stress of 90 MPa on the throat side of the 14 mm fillet weld.
I. 2.376 MPa
J. 3.590 MPa
K. 2.843 MPa
L. 1.695 Mpa
Ans. A

Which of the following dynamometer is widely used for absorption of wide range of powers at wide range of speeds?
I. Hydraulic
J. Belt transmission
K. Rope brake
L. Electric generator
Ans. A

Which of the following dynamometer is used for power measurement when the speed is high and the viscous force is small?
I. Tesla fluid friction dynamometer
J. Froude water vortex dynamometer
K. Rope brake dynamometer
L. Amsler dynamometer
Ans. A

In case of spur gears the flank of the tooth is
I. The part of the tooth surface lying below the pitch surface’
J. The curve forming face and flank
K. The width of the gear tooth measures axially along the pitch surface
L. The surface of the top of the tooth
Ans. A

The cam angle is
I. The angle of rotation of the cam for a definite displacement of the follower
J. Angle subtended by live portion of cam at the cam center’
K. The angle subtended at the cam center by the portion of cam during which the follower moves
L. The angle subtended by the cam at the cam center when the follower dwells.
Ans. A

For a kinematic chain to be considered as mechanism
I. None of the links should be fixed
J. One link should be fixed
K. Two links should be fixed
L. There is no such criterion
Ans. B

Slip in belt drive is
I. Loss of power
J. Difference between the angular velocities of two pulleys
K. Difference between the velocities of two pulleys
L. Difference between the linear speed of the rim of pulley and the belt on it.
Ans. D

Multiple collars are provided on a flat collar pivot bearing to
I. Increase frictional resistance
J. To establish self-sustaining bearing condition
K. Distribute the frictional load due to limiting friction
L. Distribute the axial load due to limiting bearing pressure on a collar
Ans. D

In gramophones for adjusting the speed of the tum-table, the following type of governor is commonly used
I. Hartung governor
J. Inertia governor
K. Pickering governor
L. Wilson hartnell
Ans. C

Shearing the sheet into two or more pieces
I. Parting
J. Perforating
K. Lancing
L. Notching
Ans. A

The mechanism used to enlarge or reduce moments for reproducing drawings to different scales is called
I. Clinograph
J. Trisquare
K. Graphometer
L. Bantograph
Ans. D

Which of the following is a higher pair?
I. Thomson an indicator mechanism
J. Double Mc Innes Indicator mechanism
K. Hart’s straight line mechanism
L. Tooth gearing mechanism
Ans. D

A process of indenting but not breaking through the surface of a workpiece with a punch in order to produce a cavity of an impression
I. Heading
J. Cogging
K. Barreling
L. Piercing
Ans. D

A turbine developing 15,000 Hp turns the shaft at 300 rpm. The propeller attached to this shaft develops a thrust of 150,000 lb. A hollow steel shaft having an outside diameter of 14 in. is to be used. Determine the inside diameter of the shaft if the maximum shearing stressed based on the torsion alone is not to exceed 7500 psi. What is the percentage savings in weight.

Ans. %W saving = 37.3%

A short compression member with Do= 2Di is to support a dead load of 25 tons. The material is to be 4130. A short compression member with Do= 2Di is to support a dead load of 25 tons. The material is to be 4130 steel, WQT 1100^{o}F. Calculate the outside and inside diameters on the basis of yield strength of 114 ksi and factor of safety of 2.
Ans. Do=1.22 in. and Di=0.61 in.

A 15/16-in wide key has a depth of 5/8 in. It is 12 inches long and is to be used on a 200 hp, 1160 rpm, squirrel-cage induction motor. The shaft diameter is 3 7/8 inches. The maximum running torque is 200% of the full-load torque. Determine the maximum compressive stress of the key
I. 779 psi
J. 997 psi
K. 197 psi
L. 279 psi
Ans. B

A storage tank for air, 36 inche in diameter, is to withstand an internal pressure of 200 psi with a design factor of 4 based on Su. The steel has the strength equivalent to C1020 annealed and the welded joints should have a relative strength (efficiency) of 90%. If Su for annealed C1020 steel is 57 ksi. Compute the longitudinal stress.
I. 128,000 psi
J. 821,000 psi
K. 800,000 psi
L. 12,800 psi
Ans. D

The mass of a flywheel is 175 kg and its radius of gyration is 380 mm. Find the torque required to attain a speed of 500 rpm from rest in 30 seconds.
I. 40.46 N
J. 44.12 N
K. 35.66 N
L. 38.48 N
Ans. B

A steel bar 24 in. in length is to withstand a tensile impact load caused by a weight of 100 lb having a velocity on impact of 140 fpm. Find the stress in the bar if the diameter is 1 ½ in and the modulus of Elasticity (E) is 30x10^{6} psi.

Ans. S=12,000 psi

The cylinder head of a 10in x 18in. freon compressor is attached by 10 stud bolts made of SAE grade 5. The cylinder pressure is 300 psi. What is the approximate tightening torque should be used to induce a tightening stress (St) of 0.90 times the proof stress if the diameter of the bolt is 5/8 in and coefficient of collar friction c = 0.2?

Ans. T = 2161 in-lb

Calculate the power consumed during cutting of a low carbon steel bar 40 mm diameter if cutting force is 150 kg at 200 rpm.
I. 0.46 hp
J. 0.66 hp
K. 0.75 hp
L. 0.83 hp
Ans. D

A broach is used to cut a key way 8mm wide, 5mmm deep in a boss 64mm long. Determine the cutting length of broach if the rise per tooth is 0.0875mm and the number of finishing teeth is 13.
I. 672 mm
J. 627 mm
K. 762 mm
L. 726 mm
Ans. C

Calculate the power of electric motor for a drilling machine to drill a hole 15 mm diameter in cast iron workpiece at 450 rpm and 0.2 mm feed. The specific power is 0.03 kW and efficiency of motor is 80%.
I. 0.6 kW
J. 0.9 kW
K. 0.7 kW
L. 0.4 kW
Ans. A

A double square thread screw is used to raise a load of 20,000 lb at a velocity of 3 fpm. Outside diameter of thread and pitch are 2 7/8 in. and 1 in. respectively. Collar friction coefficient is 0.12, thread friction coefficient is 0.10. Mean diameter of collar 5 in. Determine the power required to drive the screw.
I. 3.45 hp
J. 4.29 hp
K. 4.65 hp
L. 5.02 hp
Ans. B

Two 2 ¾ in sellers standard square thread screws are used to raise and lower a hydraulic gate weighing 60 tons. A 570 rpm electric motor operates the screws. The coefficients of collar and thread friction are 0.03 and 0.14 respectively. The mean diameter of the collar 4in. if the gate rises at the rate of 2fpm, determine the size of the motor required to lift the gate if the mechanical efficiency is 85% for the speed reducing equipment.
I. 20 hp
J. 30 hp
K. 34 hp
L. 24 hp
Ans. C

A crate weighing 4,000 lb is moving at a speed of 4ft/s. It is brought to rest by two compression spring in stopping the crate, the springs are to be compressed 8 in. If the spring index is 6 and the allowable stress is 52,000 psi, determine the maximum load on each springs.
I. 1491 lbs
J. 2037 lbs
K. 1675 lbs

L. 2453 lbs
Ans. A

What describes very rough grinding such as that performed in foundries to remove gates, fins and risers from castings?
I. Snagging
J. Honing
K. Lapping
L. Snugging
Ans. A

Which of the following is a single measure that combines the external dynamic load of an application with a gear drive's reliability and operating life?
I. Ratio factor
J. Service factor
K. Reliability factor
L. Life factor
Ans. C

What is the term used to described the distance from a point on one gear to the corresponding point measures along the base circle.
I. Diametral Pitch
J. Circular Pitch
K. Normal Pitch
L. Chordal pitch
Ans. C

Which of the following is the best method used for increasing a spring's fatigue life?
I. Sprickling
J. Shot peening
K. Stress relieving
L. Shot relieving
Ans. B

What is the term applied to parallel forces equal in magnitude but opposite direction?
I. Concurrent forces
J. Non-concurrent forces
K. Couple
L. Equillibrant
Ans. C

It is one of the rigid members / bodies joined together to form a kinematic chain.
I. Coplanar
J. Link
K. Frame
L. Machine
Ans. B

The kinematics chain in which one link is considered fixed for the purpose of analysis but motion is possible in other links.
I. Belting
J. Mechanism
K. Frame
L. Sprocket Chain
Ans. C

What describes very rough grinding, such as that performed in foundries to remove gates, fins and risers from castings?
I. Snagging
J. Honing
K. Lapping
L. Snugging
Ans. A

Two spur wheels in gear transmit a power 6.7 kW. The driver has 40 teeth of 12 mm pitch and runs at 7 rev/s,find the force on the teeth.
e. 2.0 kN
f. 1.0 kN
g. 3.0 kN
h. 4.0 kN
Ans. A