MADE EASY PUBLICATIONS

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CONTENTS

MECHANICAL ENGINEERING

Objective Practice Sets

Machine Design

8 CHAPTER

Threaded joints, Power screw, Belts

Q.1 For the maximum efficiency, the helix angle of a screw jack is equal to (f = angle of friction)

(a) $\frac{\pi}{4}+\phi$ (b) $\frac{\pi}{4}+\frac{\phi}{2}$

(c) $\frac{\pi}{4}-\phi$ (d) $\frac{\pi}{4}-\frac{\phi}{2}$

Q.2 The friction torque for square thread at mean radius while raising load is given by (W = load, R_O = Mean radius, ϕ = Angle of friction, a = Helix Angle)

(a) $WR_O \tan(\phi-\alpha)$ (b) $WR_O \tan(\phi+\alpha)$

(c) $WR_O \tan\alpha$ (d) $WR_O \tan\phi$

Q.3 In a turn buckle, if one of rods has left hand threads then the other rod will have

(a) right hand thread (b) left hand threads

(c) pointed threads (d) multiple thread

Q.4 Which of the following screw thread is adopted for power transmission in either direction?

(a) Acme thread (b) Square thread

(c) Buttress thread (d) Multiple thread

Q.5 For power transmission, square threads

(a) are the least efficient

(b) are less rigid

(c) are expensive to manufacture

(d) wear out very fast

Q.6 The load cup of a screw jack is made separate from the head of the spindle to

(a) enhance the load carrying capacity of the jack

(b) reduce the effort needed for lifting the working load

(c) reduce the value of frictional torque required to be countered for lifting the load

(d) prevent the rotation of load being lifted

Q.7 While designing a screw in a screw jack against buckling failure, the end conditions for the screw are taken as

(a) both the ends fixed

(b) both the ends hinged

(c) one end fixed and other end hinged

(d) one end fixed and the other end free

Q.8 To ensure self-locking in a screw jack it is essential that helix angle is

(a) larger than friction angle

(b) smaller then friction angle

(c) equal to friction angle

(d) such as to give maximum efficiency in lifting

Q.9 The maximum efficiency of a self-locking screw is

(a) 50% (b) 70%

(c) 75% (d) 80%

Q.10 The diameter of tommy bar of a screw jack is designed for

(a) bending moment due to effort applied

(b) torque on the tommy bar due to effort applied

(c) a percentage of axial loads

(d) some axial loads coupled with transverse loads

Q.11 A screw thread specified by M 20 × 2.5 C as per BIS thread system means

(a) Metric thread of 20 mm nominal diameter and 2.5 mm pitch having coarse tolerance

(b) Metric thread of 20 mm root diameter and 2.5 pitch having coarse tolerance

(c) Metric thread of fine class having 20 mm root diameter and 2.5 mm pitch

(d) Metric thread of 20 mm shank diameter and 2.5 mm thread depth with coarse tolerance

Q.12 The screw and nut in a broaching machine are changed from square thread to Acme thread. The power requirement of the machine at the same r.p.m. will

(a) remain same (b) decrease

(c) increase (d) depend on the square

Q.36 **Statement (I) :** V-belts results in increase in the power transmitting capacity
Statement (II) : Wedge action permits smaller arc of contact, increases the pulling capacity of the belt.

Q.37 **Statement (I) :** Two pulleys connected by a crossed belt rotate in opposite direction.
Statement (II) : The length of the crossed belt remains constant.

Q.38 **Statement (I) :** Crowning is provided on the surface of a flat pulley to prevent slipping of the belt sideways.
Statement (II) : Belt creep, which is the reason for slip of the belt sideways, is fully compensated by providing crowning on the pulley.

Q.39 In an open belt drive the centre distance is 12 m. The diameters of the driven and driver pulleys are 800 mm and 400 mm respectively. If the coefficient of friction is 0.3, the ratio of tension of tight side to slack side is _____.

Q.40 In a belt drive the linear velocity of the belt is 15 m/s and the initial tension is set to 4 kN. The ratio of tensions is 2.5. The maximum power (in kW) it can transmit is _____.

Q.41 The nominal diameter of a triple threaded square screw is 50 mm while the pitch 8 mm, the mean diameter (in mm) is _____.

■■■■

Answers — Threaded joints, Power screw, Belts

1. (d)	**2.** (b)	**3.** (a)	**4.** (b)	**5.** (c)	**6.** (d)	**7.** (d)	**8.** (b)	**9.** (a)
10. (a)	**11.** (a)	**12.** (c)	**13.** (a)	**14.** (d)	**15.** (c)	**16.** (a)	**17.** (d)	**18.** (d)
19. (d)	**20.** (c)	**21.** (b)	**22.** (b)	**23.** (a)	**24.** (d)	**25.** (a)	**26.** (c)	**27.** (d)
28. (a)	**29.** (c)	**30.** (c)	**31.** (b)	**32.** (c)	**33.** (d)	**34.** (a)	**35.** (a)	**36.** (a)
37. (c)	**38.** (c)	**39.** (2.541)	**40.** (51.424)	**41.** (46)				

Explanations — Threaded joints, Power screw, Belts

1. (d)

Efficiency of square threaded screw,

$$\eta = \frac{\tan\alpha}{\tan(\phi+\alpha)} = \frac{\sin(2\alpha+\phi)-\sin\phi}{\sin(2\alpha+\phi)+\sin\phi}$$

The coefficient of friction is constant and the only variable is (α). For efficiency (η) to be maximum, the term [sin(2α+ ϕ)] should be maximum.

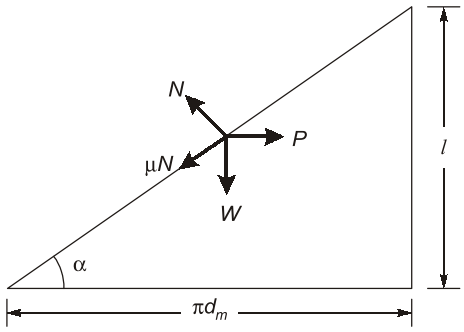
The maximum value of the 'sin' term is 1 when the angle is 90°.

$[\sin(2\alpha+\phi] = 1 \quad \text{or} \quad 2\alpha+\phi = 90°$

$$\therefore \quad \alpha = \left(\frac{\pi}{4}-\frac{\phi}{2}\right)\text{degrees}$$

2. (b)

When the load is being raised, the following forces as shown in figure act at a point on this inclined plane.



Considering equilibrium of horizontal forces,

$$P = \mu N\cos\alpha + N\sin\alpha \qquad ...(1)$$

Considering equilibrium of vertical forces,

$$W = N\cos\alpha - \mu N\sin\alpha \qquad ...(2)$$

$$\frac{(1)}{(2)} = P = \frac{W(\mu\cos\alpha+\sin\alpha)}{(\cos\alpha-\mu\sin\alpha)}$$

or, $$P = \frac{W(\mu+\tan\alpha)}{(1-\mu\tan\alpha)}$$

The coefficient of friction μ is expressed as

$$\mu = \tan\phi$$