Engineering Mechanics Test 2

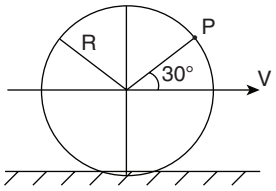
Number of Questions: 30 **Time: 75 min.**

Directions for questions 1 to 30: Select the correct alternative from the given choices.

1. The velocity-time graph of a body is passing through the velocity axis with intercept of 4. If the slope of the graph is 3, the distance travelled by the body in 6 seconds would be

(A) 40 m (B) 60 m
(C) 78 m (D) 80 m

2. A circular disc of radius 'R' rolls without slipping at a velocity 'V'. The magnitude of the velocity at point P(see figure) is



(A) $\sqrt{3}V$ (B) $\frac{\sqrt{3}}{2}V$
(C) $\frac{V}{2}$ (D) $\frac{2}{\sqrt{3}}V$

3. A particle starts with velocity 2 m/s and accelerates at a rate of 3 m/s^2 for 15 seconds and then retards at 6 m/s^2 until it stops. The total distance covered is

(A) 184.08 m (B) 551.58 m
(C) 367.5 m (D) None of these

4. A stone is projected horizontally from a cliff at 10 m/s and lands on the ground below at 20 m from the base of the cliff. Find the height 'h' of the cliff. Use g = 10 m/s^2.

(A) 18 m (B) 20 m
(C) 22 m (D) 24 m

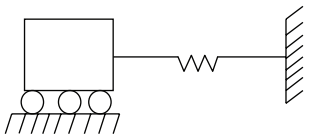
5. Two cars are going with constant speeds, round concentric circles of radii r_1 and r_2 and take the same time to complete their circular paths. Their speeds will correspond to the ratio

(A) 1 : 1 (B) $\frac{r_1}{r_2}$
(C) $\left(\frac{r_1}{r_2}\right)^2$ (D) $\frac{r_2}{r_1}$

6. A point 'P' moves along a straight line as per the law $x = 4t^2 + 12t + 1$, the velocity of the point after 3rd and 4th seconds are respectively.

(A) 36 m/s and 48 m/s
(B) 36 m/s and 44 m/s
(C) 34 m/s and 44 m/s
(D) 34 m/s and 46 m/s

7. A truck weighing 150 kN and traveling at 2 m/s impacts with a buffer spring, which compresses 1.25 cm per 10 kN. The maximum compression of the spring is



(A) 20 cm
(B) 22.85 cm
(C) 27.65 cm
(D) 30 cm

8. A particle moving in space with velocity $J = 3t^2i + 4tj - 7t^3k$. The acceleration of the particle at t = 1 will be

(A) $3i + 8j - 7k$
(B) $6i + 4j + 21k$
(C) $6i + 4j - 21k$
(D) zero

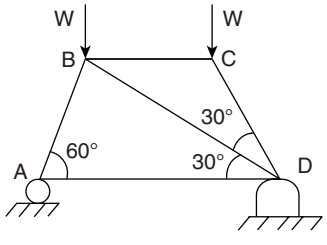
9. Match the following

	List – I		List – II
a.	Two parallel forces acting on a body moving with uniform velocity	1.	Collision
b.	A moving particle	2.	Forces in equilibrium
c.	Two coplanar forces equal in magnitude but opposite in direction	3.	Kinetic energy
d.	Co-efficient of restitution	4.	Couple

	a	b	c	d
(A)	4	3	2	1
(B)	1	2	3	4
(C)	2	3	4	1

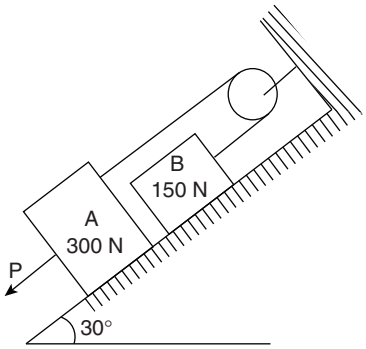
(D) None of these

10. For the truss shown in the figure, the force (N) in the member BC is



(A) 0 N(compressive)
(B) 0.577 W(tensile)
(C) 0.577 W(compressive)
(D) 0.866 W(compressive)

11.



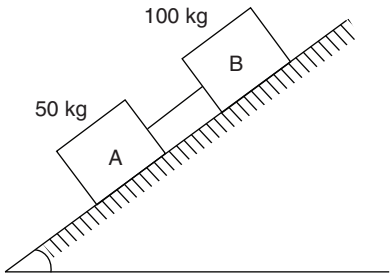
Two blocks *A* and *B* weighing 300 N and 150 N respectively are placed on a rough inclined plane of angle 30° and connected through a string over a pulley as shown in the figure. Coefficient of friction of the contact surfaces are 0.25. Force *P* required on block *A* for impending motion of the blocks is

(A) 22.43 N (B) 25.24 N
(C) 28.62 N (D) 30.14 N

12. A ball of mass 5 kg moving with a velocity of 6 m/s makes impact with another ball of mass 3 kg moving in the same direction with a velocity of 4 m/s. If coefficient of restitution is 0.5, velocities of the balls after impact are

(A) 4.875 m/s, 5.875 m/s
(B) 4.962 m/s, 6.125 m/s
(C) 5.125 m/s, 6.536 m/s
(D) 5.565 m/s, 6.926 m/s

Common Data for Questions 13 to 15:



Two blocks *A* and *B* of mass 50 kg and 100 kg are placed on an inclined plane, by connecting them by a string as shown in them figure. Coefficient of friction between block *A* and inclined plane is 0.15 and between block *B* and inclined plane is 0.4

13. Inclination of the plane when the two blocks just start to move is

(A) 10.15° (B) 17.57°
(C) 14.24° (D) 16.28°

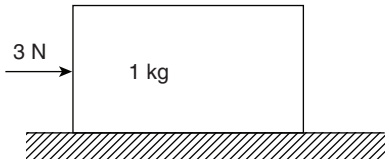
14. Tension on the string is

(A) 77.9 N (B) 31.96 N
(C) 74.3 N (D) 67.4 N

15. Angle of the inclined plane is increased to 20° and the connecting string is removed. If the coefficients of kinetic friction for blocks *A* and *B* are 0.1 and 0.35 respectively the frictional forces on *A* and *B* are

(A) 46.1 N, 369 N (B) 49.44 N, 398 N
(C) 52.14 N, 404 N (D) 56.48 N, 410 N

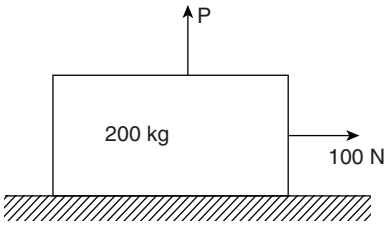
16.



A body of mass 1 kg is resting on a plane surface as shown in figure. A force of 3 N is gradually applied on one side as shown. Coefficient of static friction is 0.35 and coefficient of kinetic friction is 0.3. The friction force acting is

(A) 3.4335 N (B) 2.943 N
(C) 3 N (D) 0 N

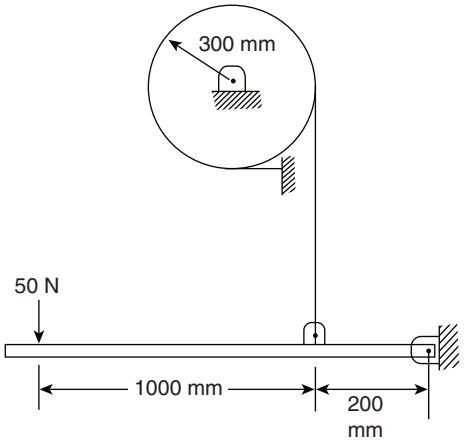
17.



A body of mass 200 kg rests on a horizontal surface as shown in the figure. Coefficient of friction between the body and surface is 0.2. If a horizontal pull of 100 N can be exerted on the body, the vertical force P required to move the body is

(A) 1462 N (B) 1418 N
(C) 1360 N (D) 1322 N

Common Data for Questions 18 and 19:

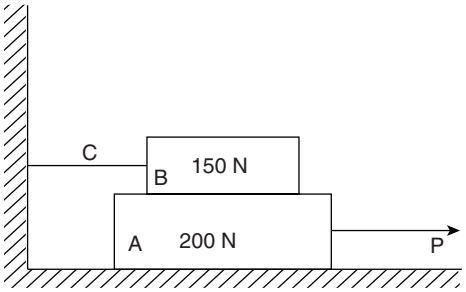


A band brake is used to control the speed of a flywheel as shown in figure. The coefficient of friction between the band and flywheel is 0.3. Radius of the flywheel is 300 mm. A force of 50 N is applied at the end of the lever as shown in the figure

18. Torque applied on the flywheel when it is rotating clockwise is
(A) 262 Nm (B) 280 Nm
(C) 315 Nm (D) 326 Nm

19. Torque applied on the flywheel when it is rotating counter clockwise is
(A) 94 Nm
(B) 82 Nm
(C) 76 Nm
(D) 68 Nm

Common Data for Questions 20 and 21:

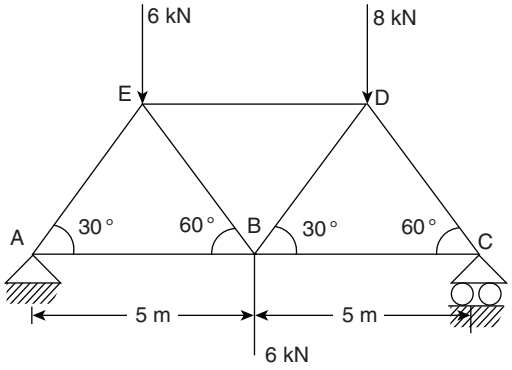


Block *A* weighing 200 N is placed on plane floor and block *B* weighing 150 N is placed over block *A*. Block *B* is constrained by a string *C* and a force *P* is applied on block *A* as shown in figure. For the contact surfaces, coefficient of static friction is 0.3 and coefficient of kinetic friction is 0.25.

20. The smallest force *P* required to start block *A* moving is
(A) 143 N
(B) 150 N
(C) 156 N
(D) 160 N

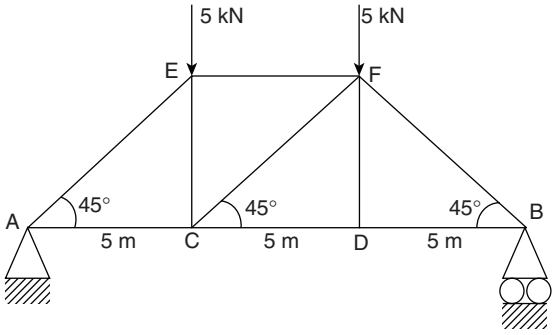
21. If a force *P* of 160 N is applied, the resultant friction forces exerted on block *A* is
(A) 110 N (B) 120 N
(C) 125 N (D) 150 N

22.



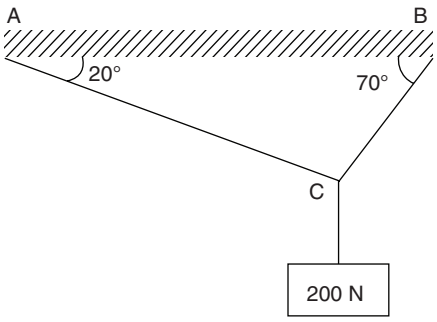
A simply supported structure is loaded as shown in the figure. Force in the member *AB* is
(A) 10.26 kN
(B) 13.42 kN
(C) 15.75 kN
(D) 17.83 kN

23.



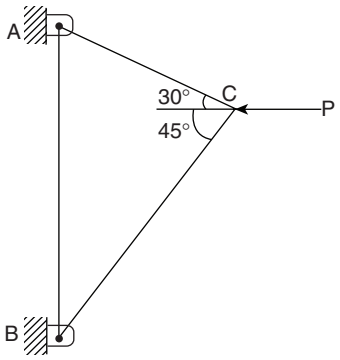
For the truss loaded as shown in figure, force in the member *CD* is
(A) 5 kN (B) 2.5 kN
(C) $\frac{5}{\sqrt{2}}$ kN (D) $5\sqrt{2}$ kN

24.



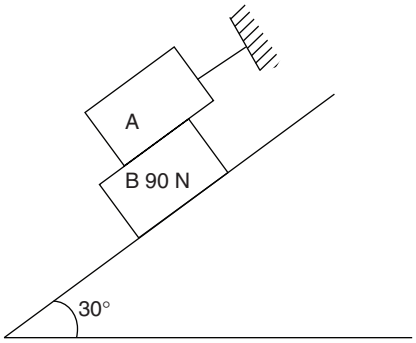
A weight of 200 N is hung using a cable as shown in the figure. Tensions in portions of cable *AC* and *BC* are respectively
(A) 59.6, 171.7 N
(B) 62.4, 176.8 N
(C) 62.5, 182.7 N
(D) 68.4, 187.9 N

25.



Two steel truss members *AC* and *BC* with cross section area 100 mm^2 is subjected to a horizontal force *P* kN as shown in figure. Maximum value of *P* such that axial stress in any of the members does not exceed 50 MPa is
(A) 10.15 kN (B) 9.22 kN
(C) 7.92 kN (D) 6.83 kN

26.



Refering to the figure given above, coefficient of friction for all surfaces of contact is 0.3. The minimum weight of block *A* required to keep block *B* in position is

(A) 35.6 N (B) 38.4 N
(C) 41.6 N (D) 44.5 N

27. A wheel at rest is accelerated uniformly from rest to 3000 rpm in 30 seconds. Its angular acceleration is

(A) 6.624 rad/s (B) 8.368 rad/s
(C) 10.472 rad/s (D) 14.376 rad/s

Common Data for Questions 28 and 29:
A pile of mass 500 kg is driven by a mass 350 kg falling on it vertically through a distance of 1 m. After impact, the falling mass and pile remain in contact and move together. The pile is moved 150 mm at each blow.

28. Energy lost in each blow is

(A) 1676 Nm (B) 1762 Nm
(C) 1915 Nm (D) 2020 Nm

29. Average resistance against the pile is

(A) 17.765 kN (B) 18.625 kN
(C) 20.516 kN (D) 22.835 kN

30. A body of mass 5 kg falls from a height of 50 m and penetrates into the ground by 90 cm. Average resistance to penetration is

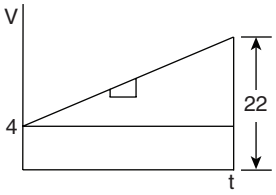
(A) 2668 N (B) 2774 N
(C) 2814 N (D) 2892 N

Answer Keys

1. C	**2.** A	**3.** B	**4.** B	**5.** B	**6.** B	**7.** C	**8.** C	**9.** C	**10.** C
11. A	**12.** A	**13.** B	**14.** A	**15.** A	**16.** C	**17.** A	**18.** B	**19.** D	**20.** B
21. C	**22.** B	**23.** A	**24.** D	**25.** D	**26.** C	**27.** C	**28.** D	**29.** A	**30.** B

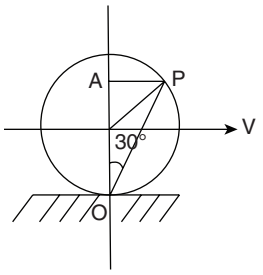
Hints and Explanations

1.



$a = 3$.
$v = u + at = 4 + 3 \times 6$
$= 22$ m/s
Distance travelled = Area under the curve
$= 6 \times 4 + \frac{1}{2} \times 18 \times 6 = 24 + 54 = 78$ m Choice (C)

2.



the instantaneous center of rotation of the disk is *O*, i.e, its point of contact with ground every other point on the disk is rotating with respect to this center with an angular velocity.

$\omega = \frac{V}{R}$

Velocity of $P = \omega \cdot OP$

$OP = \sqrt{R^2 + R^2 - 2R^2 \cos 120°}$

$= \sqrt{3R^2} = \sqrt{3}R$

$V_P = \frac{V}{R} \cdot \sqrt{3}R = \sqrt{3}V$ Choice (A)

3. $S = ut + \frac{1}{2}at^2$

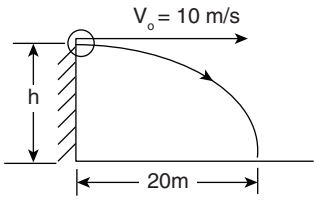
$u = 2$ m/s
$a = 3$ m/s^2

$S_1 = 2(15) + \frac{1}{2} \times 3(15)^2 = 367.5$ m

$v = u + at = 2 + 3(15) = 47$m/s
$v^2 - u^2 = 2as$
$0 - 47^2 = 2(-6)s_2$
$s_2 = \frac{47^2}{12} = 184.08$ m/s

Total distance covered is $= S_1 + S_2 = 367.5 + 184.08$
$= 551.58$ m/s Choice (B)

4.



time of flight = $\frac{20}{10}$ = 2 sec

Since horizontal component of velocity remains constant therefore

$h = \frac{1}{2}gt^2 = \frac{1}{2}\times 10\times 2^2 = 20$ m Choice (B)

5. We know $t_1 = \frac{2\pi r_1}{v_1}$

And $t_2 = \frac{2\pi r_2}{v_2}$

But $t_1 = t_2$

Therefore $\frac{v_1}{r_1} = \frac{v_2}{r_2}$

Since $v = \omega r$, therefore

$$\frac{\omega_1 r_1}{r_1} = \frac{\omega_2 r_2}{r_2}$$

$\omega_1 = \omega_2$

$\frac{v_1}{r_1} = \frac{v_2}{r_2}$

$\therefore \quad \frac{v_1}{v_2} = \frac{r_1}{r_2}$ Choice (B)

6. $X = 4t^2 + 12t + 1$

Velocity, $v = \frac{dX}{dt} = 8t + 12$

(v) $t = 3$sec $= 8(3) + 12 = 36$ m/s

(v) $t = 4$sec $= 8(4) + 12 = 44$ m/s Choice (B)

7. $\frac{1}{2}mV^2 = \frac{1}{2}KX^2$

$m = \frac{w}{g} = \frac{150\times 10^3}{9.81} = 15290$ kg

$15290\ (2)^2 = \frac{10000}{1.25\times 10^{-2}}x^2$

$\Rightarrow \quad x = 27.65$ cm. Choice (C)

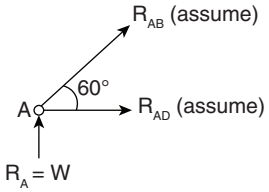
8. Velocity, $J = 3t^2 i + 4tj - 7t^3 k$

Acceleration, $\frac{dJ}{dt} = 6ti + 4j - 21t^2 k$

At $t = 1$

Acceleration, $\frac{dJ}{dt} = 6i + 4j - 21k$. Choice (C)

10. Considering pin A

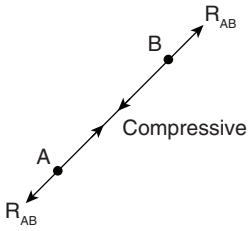


$\Sigma F_y = 0$

$\therefore \quad R_{AB}\sin 60° + R_A = 0$

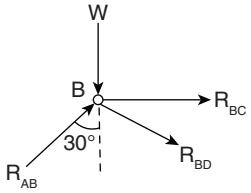
$\therefore \quad R_{AB} = -1.1547$W

Considering tress member *AB*



$R_{AB} = +1.1547$W

Considering pin *B*



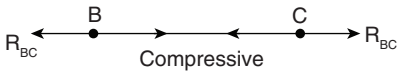
$\Sigma f_x = 0$

$\therefore \quad R_{AB}\sin 30° + R_{BC} = 0$

$\therefore \quad R_{Bc} = -1.1547$W $\sin 30°$

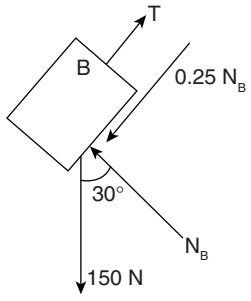
$R_{Bc} = -0.577$W

Considering tress member *BC*



$\therefore \quad R_{Bc} = 0.577$W(compressive) Choice (C)

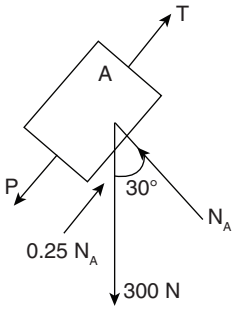
11. Consider free body diagram of block B. Let T be the tension on the string



$N_B = 150\cos 30 = 129.9$ N

$T = 150\sin 30 + 0.25\,N_B = 75 + 0.25\times 129.9 = 107.48$ N

Consider free body diagram of block A



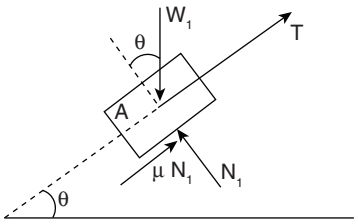
$N_A = 300 \cos 30 = 259.8$ N
$P + 300 \sin 30 = T + 0.25\ N_A$
$P = 107.48 + 0.25 \times 259.8 - 150 = 22.43$ N.
Choice (A)

12. $m_1 = 5$ kg, $u_1 = 6$ m/s
$m_2 = 3$ kg, $u_2 = 4$ m/s, $e = 0.5$
Applying momentum equation
$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$
i.e., $5 \times 6 + 3 \times 4 = 5 \times v_1 + 3 \times v_2$
$5v_1 + 3v_2 = 42$ ——————————(1)
From Newton's law of collision of elastic bodies,

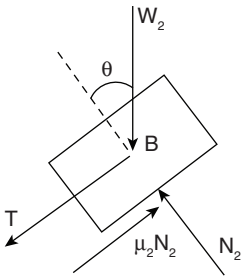
$$e = \frac{v_2 - v_1}{u_1 - u_2}$$

$v_2 - v_1 = e(u_1 - u_2) = 0.5\ (6 - 4)$
$v_2 - v_1 = 1$ ——————————(2)
From (1) and (2)
$v_1 = 4.875$ m/s
$v_2 = 5.875$ m/s. Choice (A)

13. Let T be the tension in the spring
Considering block A alone



$N_1 = W_1 \cos \theta$
$W_1 \sin \theta = T + \mu N_1 = T + 0.15\ W_1 \cos \theta$
$T = 50 \times 9.81 \sin \theta - 0.15 \times 50 \times 9.81 \cos \theta$
$= 490.5 \sin \theta - 73.575 \cos \theta$ ————————(1)
Considering block B



$N_2 = W_2 \cos \theta$
$T + W_2 \sin \theta = \mu_2 N_2 = 0.4 \times 100 \times 9.81 \cos \theta$
$T + 981 \sin \theta = 392.4 \cos \theta$ ——————————(2)
From (1) and (2)
$(490.5 \sin \theta - 73.575 \cos \theta) + 981 \sin \theta = 392.4 \cos \theta$
$1471.5 \sin \theta - 465.975 \cos \theta = 0$

$$\tan \theta = \frac{465.975}{1471.5} = 0.3167$$

$\theta = 17.57°$. Choice (B)

14. $T = 490.5 \sin 17.57 - 73.575 \cos 17.57 = 77.925$ N.
Choice (A)

15. Consider block A for static condition
$T = 490.5 \sin \theta - 73.575 \cos \theta$
As there is no connecting string
$490.5 \sin \theta - 73.525 \cos \theta = 0$
$\tan \theta = 0.15$
$\theta = 8.525°$
As θ is given as 20° the block moves down
Frictional force $= \mu_k \times N_1 = \mu_k \times W_1 \cos \theta$
$= 0.1 \times 50 \times 9.81 \cos 20 = 46.1$ N
For the static condition of block B
$981 \sin \theta = 392.4 \cos \theta$
$\tan \theta = 0.4$
$\theta = 21.8°$
$\therefore$ The block is stationary at an angle 20° and static friction is active
Frictional force $= \mu_s \times N_2 = \mu_s \times W_2 \cos \theta$
$= 0.4 \times 100 \times 9.81 \cos 20$
$= 368.735$ N. Choice (A)

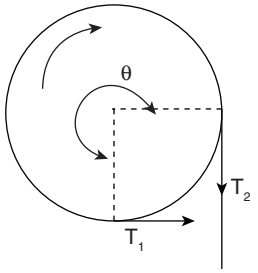
16. Weight of the body $W = mg = 1 \times 9.81 = 9.81$ N
Static friction force $= W \times \mu_s = 9.81 \times 0.35 = 3.4335$ N
Kinetic friction force $= W \times \mu_k = 9.81 \times 0.3 = 2.943$ N
The applied force is 3 N. The body will start moving only when applied force exceeds the static friction force. After this the kinetic friction force will come into action.
So the friction force acting is 3 N. Choice (C)

17. Weight of the body $= mg = 200 \times 9.81 = 1962$ N
Frictional force $= (mg - P)\mu = (1962 - P)0.2$
For moving the body
$100 \geq (1962 - P) \times 0.2$

$$1962 - P = \frac{100}{0.2}$$

$P = 1962 - 500 = 1462$ N. Choice (A)

18.



For clock wise rotation of the flywheel, band connected to the lever is slack side and corresponding tension is T_2

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

where θ = wrapping angle = 270° = $\frac{3\pi}{2}$ radian

$$\frac{T_1}{T_2} = e^{0.3\times\frac{3\pi}{2}} = 4.11$$

$T_2 \times 200 = 50 \times 1200$

$T_2 = 300$ N

$\therefore \quad T_1 = T_2 \times 4.11 = 300 \times 4.11 = 1233$ N

Torque on the fly wheel = $(T_1 - T_2)\, r$

$= (1233 - 300)\, 0.3 = 280$ Nm. Choice (B)

19. For anti clockwise rotation tight side of the band is connected to the lever i.e., T_1 acts on the lever

$\therefore \quad T_1 \times 200 = 50 \times 1200$

$T_1 = 300$ N

$$\frac{T_1}{T_2} = 4.11$$

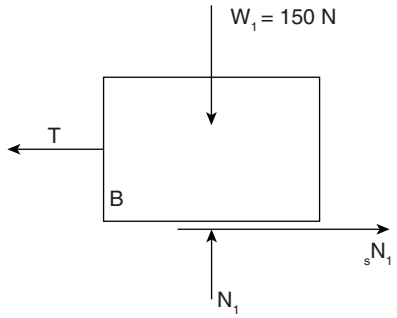
$$T_2 = \frac{T_1}{4.11} = \frac{300}{4.11} = 73 \text{ N}$$

Torque = $(T_1 - T_2)r$

$= (300 - 73)0.3 = 68$ Nm. Choice (D)

20. Consider block B,

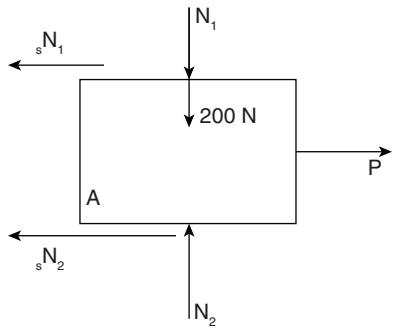
Let T be the tension in the string



$N_1 = W_1 = 150$ N

$T = \mu_s \times N_1 = 0.3 \times 150 = 45$ N

Consider Block A



$N_2 = N_1 + 200 = 150 + 200 = 350$ N

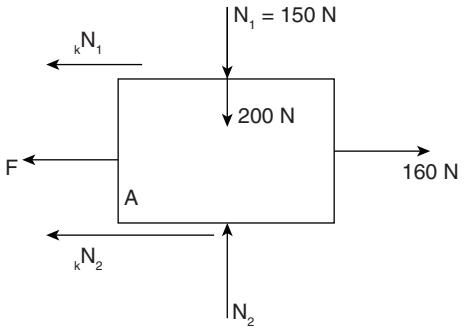
$P = \mu_s N_1 + \mu_s N_2 = 45 + 0.3 \times 350 = 150$ N. Choice (B)

21. Static friction forces to overcome for the movement of A = 150 N

For force P above 150 N

Kinetic friction is active

Considering block A

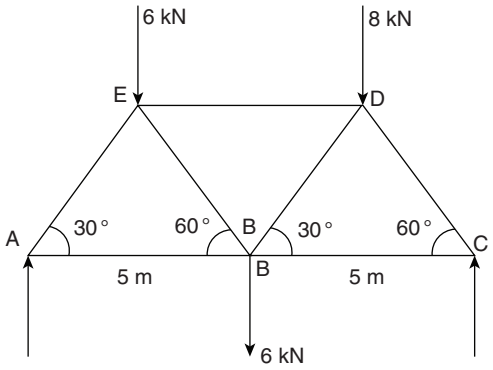


Resultant friction forces = $\mu_k N_1 + \mu_k N_2$

$= 0.25 \times 150 + 0.25\,(150 + 200)$

$= 37.5 + 87.5 = 125$ N. Choice (C)

22.



$V_A + V_C = 6 + 8 + 6 = 20$ kN

Taking moment about A

$$V_C \times 10 = 6 \times \frac{5\times3}{4} + 6\times5 + 8\left(5 + \frac{5\times3}{4}\right)$$

$V_C = 12.25$ kN

$\therefore \quad V_A = 20 - 12.25 = 7.75$ kN

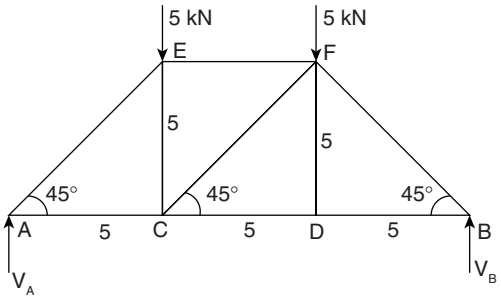
considering joint A $T_{AE} \sin 30 = V_A$

$$T_{AE} = \frac{7.75}{0.5} = 15.5 \text{ kN}$$

$T_{AB} = T_{AE} \cos 30 = 15.5 \times \cos 30 = 13.42$ kN.

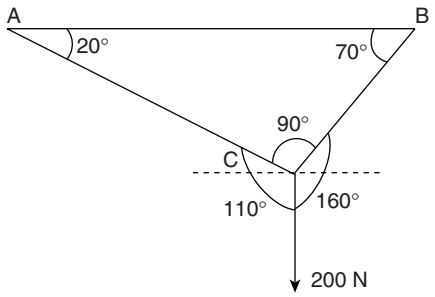
Choice (B)

23.



By symmetry
$V_A = V_B = 5$ kN
Considering joint B,
$T_{FB} \sin 45 = V_B = 5$
$T_{DB} = T_{FB} \cos 45 = 5$ kN as sin 45 = cos 45
considering joint D $T_{CD} = T_{DB} = 5$ kN. Choice (A)

24.

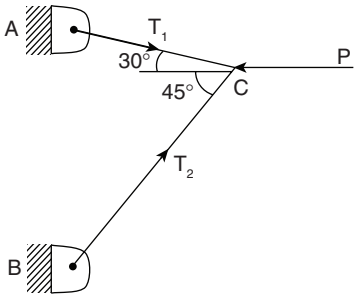


Applying Lami's theorem

$$\frac{T_{AC}}{\sin 160} = \frac{T_{BC}}{\sin 110} = \frac{200}{\sin 90} = 200$$

$T_{AC} = 200 \times \sin 160 = 68.4$ N
$T_{BC} = 200 \times \sin 110 = 187.94$ N Choice (D)

25.



Considering the joint P,
$T_1 \cos 30 + T_2 \cos 45 = P$
$T_1 \sin 30 = T_2 \sin 45$

$$\frac{T_1}{T_2} = \frac{\sin 45}{\sin 30} = 1.414$$

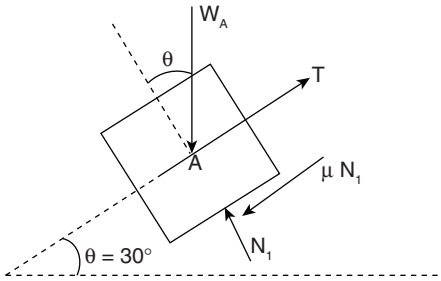
$T_1 = 1.414\ T_2$
$1.414\ T_2 \cos 30 + T_2 \cos 45 = P$
$T_2 = 0.5177\ P$
$T_1 = 0.732\ P$
Maximum force is in the member AC
$T_{AC} = T_1 = 0.732\ P$ kN

$$\text{Axial stress} = \frac{0.732 \times 10^3 P}{100} = 7.32\ P \text{ N/mm}^2$$

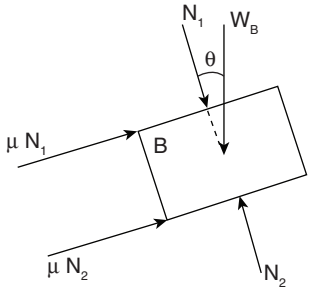
$$= 7.32\ P \text{ MPa}$$

$\therefore$ $7.32\ P \le 50$ MPa
$P \le 6.83$ kN. Choice (D)

26.



Consider the free body diagram of block A
$N_1 = W_A \cos 30$ ——————(1)
$\mu N_1 + W_A \sin 30 = T$



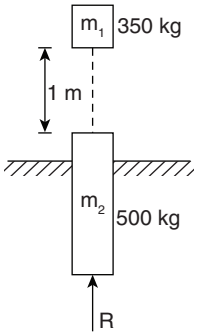
Consider free body diagram of B
$N_1 + W_B \cos \theta = N_2$
i.e., $N_1 - N_2 = -90 \times \cos 30$
$= -77.942$ ——————(2)
$\mu(N_1 + N_2) = W_B \sin 30$
$0.3(N_1 + N_2) = 90 \times 0.5$
$N_1 + N_2 = 150$ ——————(3)
From (2) and (3)
$2\ N_1 = 72.06$
$N_1 = 36$ N
Substituting in (1)
$36 = W_A \cos 30$
$\therefore$ $W_A = 41.6$ N. Choice (C)

27. $\omega_0 = 0$

$$\omega = \frac{2\pi N}{60} = \frac{2\pi \times 3000}{60} = 100\ \pi \text{ rad/s}$$

$t = 30$ s
$\omega = \omega_0 + \alpha\ t$
$100\ \pi = 0 + \alpha \times 30$
$\alpha = 10.472$ rad/s. Choice (C)

28.



$m_1 = 350$ kg, $m_2 = 500$ kg
$S = 1$ m, $x = 150$ mm $= 0.15$ m
Let V_1 be the velocity of mass m_1 when hitting m_2

$$V_1 = \sqrt{2gS} = \sqrt{2 \times 9.81 \times 1} = 4.43 \text{ m/s}$$

V_2 = Velocity of pile before impact
V = Common velocity after impact

$$m_1V_1 + m_2V_2 = (m_1 + m_2)V$$
$$350 \times 4.43 + 0 = (350 + 500)V$$
$$\therefore \quad V = 1.824 \text{ m/s}$$

Kinetic energy before impact $= \frac{1}{2} m_1V_1$

$$= \frac{1}{2} \times 350 \times (4.43)^2 = 3434.36 \text{ Nm}$$

Kinetic energy after impact $= \frac{1}{2} (m_1 + m_2) V^2$

$$= \frac{1}{2} (350 + 500) \times (1.824)^2 = 1413.96 \text{ Nm}$$

Energy lost in blow = 3434.36 – 1413.96
= 2020.4 N/m. Choice (D)

29. Let R be the average resistance against the pile.
Net work done = kinetic energy after impact

$$(R - m_1g - m_2g)x = \frac{1}{2} (m_1 + m_2)V^2$$

$$(R - 350 \times 9.81 - 500 \times 9.81)\ 0.15 = 1413.96$$
$R = 17765$ N $= 17.765$ kN. Choice (A)

30. m = 5 kg, $h = 50$ m
$x = 90$ cm $= 0.9$ m

$$v_1 = \sqrt{2gh} = 4.43 \sqrt{h} = 4.43 \sqrt{50} = 31.32 \text{ m/s}$$

$v_2 = 0$
Let R be the average resistance of penetration

$$\frac{1}{2} \text{m}(v_2^2 - v_1^2) = (\text{mg} - R)\, x$$

$$\frac{1}{2} \times 5(0 - 31.32^2) = (5 \times 9.81 - R)\ 0.9$$

$$\Rightarrow \quad 49.05 - R = 2724.84$$
$R = 2773.89$ N Choice (B)