Assignment 8

The due date for submitting this assignment has passed. Due on 2018-04-04, 23:59 IST.

Submitted assignment

1) For the car-lifting mechanism shown, \( L = 2b = 2 \text{ m} \), and \( \theta = 30^0 \). If the weight of the car being lifted is 20 kN, then find the force exerted on the piston in kN.

- 28.7 kN
- 32.1 kN
- 35.6 kN
- 42.9 kN

No, the answer is incorrect.
Score: 0
Accepted Answers:
42.9 kN

2) The operating pressure \( (p) \) inside the cylinder is 1 MPa, cross-sectional area \( (A_p) \) of the piston is 8000 mm\(^2\), length of the crank \( (r) \) is 100 mm, and length of the connecting rod \( (l) \) is 200 mm. For \( \theta = 60^0 \), find the amount of torque \( (\tau) \) required to be
applied at point O on the crank to resist its rotation.

3) In the configuration of the 4R mechanism, points C, A and D are collinear with CA=2 cm, AB=5 cm, BD=4 cm, CD=6 cm. A 5 Nm torque ($\tau_C$) is applied on link CA at point C to rotate it in CCW direction. Calculate the torque ($\tau_D$) required to be exerted on link BD at point D in CCW direction to prevent its motion.

- 5 Nm
- 8 Nm
- 10 Nm
- 12.5 Nm

No, the answer is incorrect.
Score: 0
Accepted Answers:
10 Nm
4) A force of 50 N \((F)\) is applied at point B in a direction perpendicular to link OB \(1 \text{ point}\). Whose length is 50 mm. Find the torque to be applied at point C on the slotted link in CCW direction to resist its rotation.

- 1.06 Nm (Counter clockwise)
- 1.43 Nm (Counter clockwise)
- 2.14 Nm (Counter clockwise)
- 3.8 Nm (Counter clockwise)

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.06 Nm (Counter clockwise)

5) For the given crimping tool with \(l_2 = 3 \text{ cm}, l_3 = 4 \text{ cm}, l_4 = 6 \text{ cm}, a = 10 \text{ cm}, b = 4 \text{ cm}\), the difference between the angular orientation of link 2 and link 3 is 10°, and that for link 4 and link 3 is 80°. Find the output force \((F_O)\) generated, if the input force \((F_I)\) is 10 N.

- 150.42 N
- 214.7 N
- 283.6 N
- 387.1 N

No, the answer is incorrect.
Score: 0
Accepted Answers:
283.6 N

6) The upper jaw D of the toggle press slides with negligible frictional resistance \(1 \text{ point}\) along the fixed vertical column. Determine the required force \(F\) on the handle to produce a
compression force of 500 N on the roller at point E with $\theta = 60^\circ$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
200 N

For the serial robotic manipulator with $l_1 = l_2 = 3\,\text{cm}$, $\theta_1 = 30^\circ$, $\theta_2 = 45^\circ$, find the resisting torques ($\tau_1$ and $\tau_2$) required to be applied at the revolute joints to resist motion when the end effector supports a weight of 100 N ($\vec{F}_D = 100\,\text{N}$).
\( \tau_1 = -182.64 \text{ N-cm}, \tau_2 = -42.78 \text{ N-cm.} \)

\( \tau_1 = 197.44 \text{ N-cm}, \tau_2 = 2.01 \text{ N-cm.} \)

\( \tau_1 = 254.32 \text{ N-cm}, \tau_2 = 24.6 \text{ N-cm.} \)

\( \tau_1 = 337.45 \text{ N-cm}, \tau_2 = 77.65 \text{ N-cm.} \)

No, the answer is incorrect.

Score: 0

Accepted Answers:
\( \tau_1 = 337.45 \text{ N-cm}, \tau_2 = 77.65 \text{ N-cm.} \)

8) For the RR serial robotic manipulator (with \( l_1 = 5 \text{ cm}, l_2 = 4 \text{ cm, } \theta_1 = 40^\circ, \theta_2 = 25^\circ \)), find the element 12 (1\text{st} \text{ row} 2\text{nd} \text{ column}) of the transformation matrix \( ^0T_2 \).
9) For the RP robotic manipulator (with \( l_1 = 3 \text{ cm}, s = 2 \text{ cm}, \theta = 60^\circ, \alpha = 30^\circ \)), find the element 23 (2\(^{nd}\) row 3\(^{rd}\) column) of the transformation matrix \( ^0T_2 \).

No, the answer is incorrect.
Score: 0
Accepted Answers:
-0.91
10) Vector $\mathbf{AB}$ is expressed as $3\hat{i}_1$ in $X_1OY_1$ coordinate system ($\hat{i}_1$ being unit vector in $X_1$ direction in $X_1OY_1$ coordinate system) which is obtained by translating the coordinate system $XOY$ from $O$ to $O_1$ and then rotating by an angle $\theta=30^\circ$ in CCW direction. The coordinates of point $O_1$ in XOY coordinate system is given by (4,6). Express vector $\mathbf{AB}$ in XOY coordinate system using the concept of homogeneous transformation.