Choose the correct answer from the options.

Question 1: A solid cast iron disc, 1130.97 kg mass, is used as a flywheel. The radius of gyration of the solid disc is 0.3535 m about its axis of rotation. It is rotating at an angular speed of 36.65 rad/s and brought to rest by means of a brake. The energy absorbed by the brake is:

A. 61 kJ B. 76 kJ C. 94 kJ D. 107 kJ

Question 2: Consider the following statements regarding joints:

1. A joint is the connection between two or more links at their nodes.
2. If a joint connects only two links, the entity is also called a kinematic pair.
3. If a one degree of freedom joint imposes a translation motion, it is called a prismatic joint.

Which of the above statements are correct?

A. 1 and 2 only B. 1 and 3 only C. 2 and 3 only D. 1, 2 and 3

Question 3: If E = Mean kinetic energy of the flywheel, Cs = Coefficient of fluctuation of speed and ΔE = Maximum fluctuation of energy, then:

A. $\Delta E = E / Cs$ B. $\Delta E = E^2 \times Cs$ C. $\Delta E = E \times Cs$ D. $\Delta E = 2E \times Cs$

Question 4: The rotary internal combustion engine is the inversion of _____.

A. Four bar link chain B. Double slider crank chain C. Single slider crank mechanism D. Rocker crank mechanism

Question 5: A minimum number of links that can make a mechanism are:

A. 2 B. 3 C. 4 D. None of these

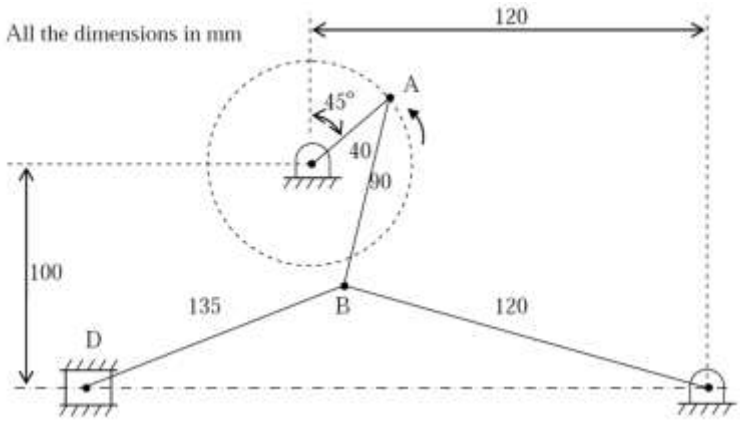
Question 6: Identify lower pairs. Select the most appropriate answer.

A. Ball and socket B. Cam and follower C. Piston and cylinder D. Both (1) and (2)

Question 7 : The turning moment curve for an engine is represented by the equation $T(\theta) = 20000 + 9500\sin 2\theta - 5700\cos 2\theta$ (Nm), where θ is the angle moved by the crank from inner dead centre. If the resisting torque is constant, find: (1) Power developed by the engine, (2) Moment of inertia of the flywheel in kg-m^2, if the total fluctuation of speed is not to exceed 1.0% of the mean speed which is 180rpm, and(3) Angular acceleration of the flywheel when the crank has turned through 45^o from inner dead centre.

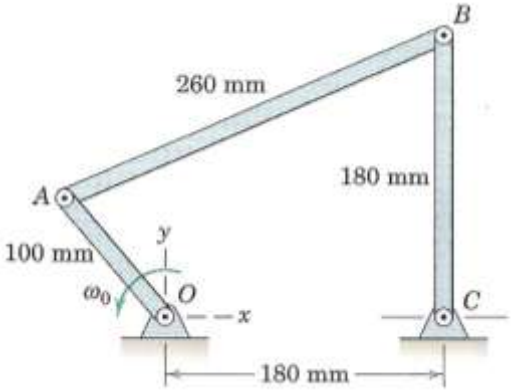
Question 8: By SolidWorks

Figure below shows a toggle mechanism in which the crank OA rotates at 120 rpm. Find the velocity and acceleration of the slider D.



Question 9: By GIM

In the four-bar linkage shown, control link OA has a counterclockwise angular velocity $\omega_0 = 10$ rad/s during a short interval of motion. When link CB passes the vertical position shown, point A has coordinates $x = -60$ mm and $y = 80$ mm. By means of vector algebra determine the angular velocities of AB and BC.



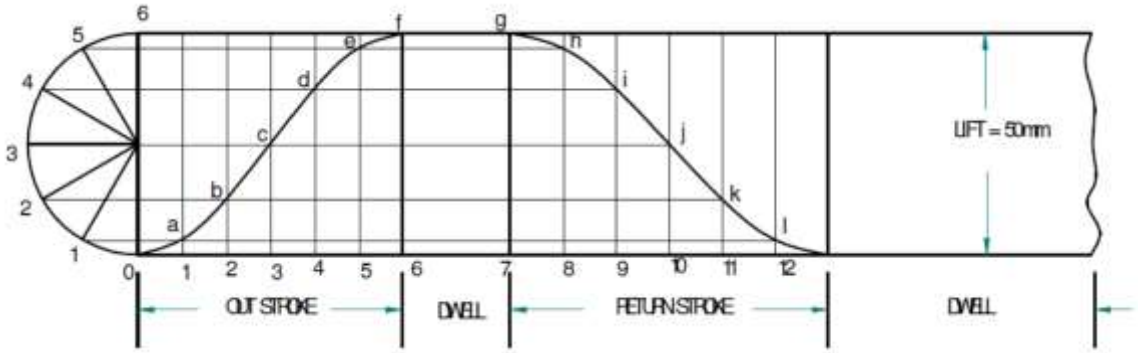
Choose one of the following two questions.

Question 10: Resolve Question 7 by Python.

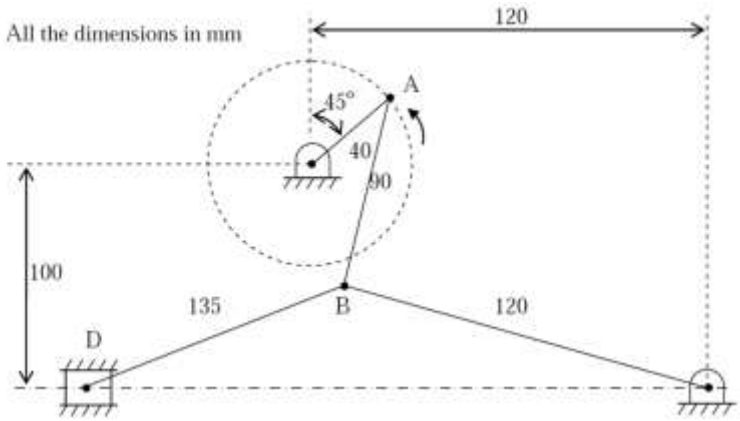
Question 11: Draw the cam profile for following conditions:

Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with SHM, for 60^0 cam rotation; dwell for 45^0 cam rotation; return stroke with SHM, for 90^0 cam rotation; dwell for the remaining period. **Determine** max. velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction.

Displacement diagram:

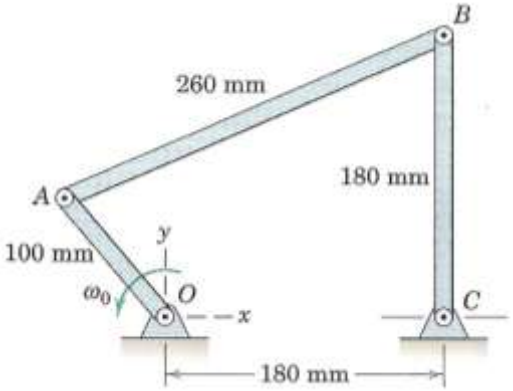


Question 8: By SolidWorks
Figure below shows a toggle mechanism in which the crank OA rotates at 120 rpm. Find the velocity and acceleration of the slider D.



Question 9: By GIM

In the four-bar linkage shown, control link OA has a counterclockwise angular velocity $\omega_0 = 10$ rad/s during a short interval of motion. When link CB passes the vertical position shown, point A has coordinates $x = -60$ mm and $y = 80$ mm. By means of vector algebra determine the angular velocities of AB and BC.



Choose one of the following two questions.

Question 10: Resolve Question 7 by Python.

Question 11: Draw the cam profile for following conditions:
Follower type = roller follower, in-line; lift = 25mm; base circle radius = 20mm; roller radius = 5mm; out stroke with UARM, for 120^0 cam rotation; dwell for 60^0 cam rotation; return stroke with UARM, for 90^0 cam rotation; dwell for the remaining period.
Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 1200 rpm in clockwise direction.
Displacement diagram: