

GOVERNMENT ENGINEERING COLLEGE, BHUJ
MECHANICAL ENGINEERING DEPARTMENT
MID SEM EXAM MARKS (EVEN TERM-2025-26)
BE-2nd YEAR, SEM-IV

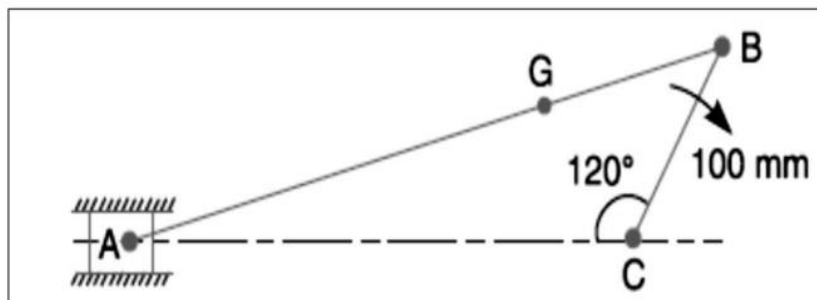
Subject - Kinematics and Theory of Machines (BE04000171)

Assignment: - Writing Numerical based assignment

All the students are informed to solve and write all the numerical based assignment in single side file page and submit it on or before 6/5/2026.

Assignment - 1

1	A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke.
2	In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.
3	A four-bar mechanism is to be designed, by using three precision points, to generate the function $y = x1.5$, for the range $1 < x < 4$. Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of x , y , θ and ϕ corresponding to the three precision points.
4	Design a four-bar mechanism to co-ordinate the input and output angles as follows: Input angles = 15° , 30° , and 45° ; Output angles = 30° , 40° , and 55° .
5	Four bar Crank-Rocker quick return linkage for specified time ratio. Time ratio = 1:1.25 with 45° output rocker motion. Design the synthesis. The mechanism, as shown in the figure, has the dimensions of various links as follows: $AB = DE = 150$ mm; $BC = CD = 450$ mm; $EF = 375$ mm. The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the fixed-point D , which is connected to AB by the coupler BC . The block F moves in the horizontal guides, being driven by the link EF . Determine: 1. velocity of the block F , 2. angular velocity of DC , and 3. rubbing speed at the pin C which is 50 mm in diameter. The crank of the slider-crank mechanism rotates clockwise at a constant speed of 300
6	An engine mechanism is shown in the figure. The crank $CB = 100$ mm and the connecting rod $BA = 300$ mm with the centre of gravity G , 100 mm from B . In the position shown, the crankshaft has a speed of 75 rad/s and angular acceleration of 1200 rad/s^2 . Find: 1. The velocity of G and angular velocity of AB , and 2. Acceleration of G and angular acceleration of AB .



Assignment - 2

1	<p>A cam is to give the following motion to a knife-edged follower:</p> <ol style="list-style-type: none"> 1. Outstroke during 60° of cam rotation; 2. Dwell for the next 30° of cam rotation; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation. <p>The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when (a) the axis of the follower passes through the axis of the camshaft, and (b) the axis of the follower is offset by 20 mm from the axis of the camshaft.</p>
2	<p>A cam is to be designed for a knife-edge follower with the following data:</p> <ol style="list-style-type: none"> 1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2. Dwell for the next 30°. 3. During the next 60° of cam rotation, the follower returns to its original position with SHM. 4. Dwell during the remaining 180°. <p>Draw the profile of the cam when</p> <ol style="list-style-type: none"> (a) the line of stroke of the follower passes through the axis of the camshaft, and (b) the line of stroke is offset 20 mm from the axis of the camshaft. <p>The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m.</p>
3	<p>A cam drives a flat reciprocating follower in the following manner:</p> <p>During the first 120° rotation of the cam, the follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During the next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.</p>
4	<p>A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife-edge follower the motion as described below:</p> <ol style="list-style-type: none"> 1. To move outwards through 40 mm during 100° rotation of the cam; 2. To dwell for the next 80°; 3. To return to its starting position during the next 90°, and 4. To dwell for the rest period of a revolution i.e. 90°. <p>Draw the profile of the cam</p> <ol style="list-style-type: none"> (i) when the line of stroke of the follower passes through the centre of the camshaft, and (ii) when the line of stroke of the follower is off-set by 15 mm. <p>The displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the camshaft rotates at 900 r.p.m. Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.</p>
5	<p>Construct the profile of a cam to suit the following specifications:</p> <p>Camshaft diameter = 40 mm; Least radius of cam = 25 mm; Diameter of roller = 25 mm; The angle of lift = 120°; Angle of fall = 150°; Lift of the follower = 40 mm; Number of pauses are two of the equal intervals between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the camshaft is uniform. The line of stroke of the follower is offset 12.5 mm from the centre of the cam.</p>

Assignment - 3

1	<p>A shaft runs at 80 rpm and drives another shaft at 150 rpm through a belt drive. The diameter of the driving pulley is 600 mm. determine the diameter of the driven pulley in the following cases.</p> <p>a) Neglecting belt thickness.</p> <p>b) Taking belt thickness as 5mm.</p> <p>c) Assuming for case (ii) total slip of 4%.</p> <p>d) Assuming for case (ii) a slip of 2% on each pulley.</p>
2	<p>Two parallel shafts connected by a crossed belt, are provided with pulleys 480 mm and 640 mm in diameters. The distance between the centre line of the shaft is 3 m. Find by how much the length of the belt should be changed if it is desired to alter the direction of rotation of the driven shaft.</p>
3	<p>A belt runs over a pulley of 800 mm diameter at a speed of 180 rpm. The angle of the lap is 165° and the maximum tension in the belt is 2kN. Determine the power transmitted if the coefficient of friction is 0.3.</p>
4	<p>A casting weights 6 kN and is freely suspended from a rope which makes 2.5 turns round a drum of 200 mm diameter. If the drum rotates at 40 rpm, determine the force required by a man to pull the rope from the other end of the rope. Also, find the power to raise the casting. The coefficient of friction is 0.25.</p>
5	<p>The force required just to move a body on a rough horizontal surface by pulling is 320 N inclined at 30° and by pushing 380 N at the same angle. Find the weight of the body and the coefficient of friction.</p>
6	<p>A body is to be moved up an inclined plane by applying a force parallel to the plane surface. It is found that a force of 3 KN is required to just move it up the plane when the angle of inclination is 10° whereas the force needed increase to 4 KN when the angle of inclination is increased to 15°. Determine the weight of the body and the coefficient of friction.</p>

Assignment - 4

1	A Whitworth bolt with an angle of V-threads as 55° has a pitch of 6 mm and a mean diameter of 32 mm. the mean radius of the bearing surface where the nut is tightened is 20 mm. Determine the force required at the end of a 400 mm long spanner when the load on the bolt is 8 KN. The coefficient of friction for the nut and the bolt is 0.1 and for the nut and the bearing surface is 0.15.
2	The number of teeth of spur gear is 30 and it rotates at 200 RPM. What will be its circular pitch and the pitch line velocity if it has a module of 2 mm?
3	The following data relate to two meshing gears velocity ratio = $1/3$, module = 1mm, Pressure angle 20° , center distance= 200 mm. Determine the number of teeth and the base circle radius of the gear wheel.
4	Each of the gears in a mesh has 48 teeth and a module of 8 mm. The teeth are of a 20° involute profile. The arc of contact is 2.25 times the circular pitch. Determine the addendum.
5	Two involute gears in mesh have a 20° pressure angle. The gear ratio is 3 and the number of teeth on the pinion is 24. The teeth have a module of 6 mm. The pitch line velocity is 1.5 m/s and the addendum equal to one module. Determine the angle of action of a pinion (the angle turned by the pinion when one pair of teeth is in the mesh) and the maximum velocity of sliding.
6	Two 20° involute spur gears have a module of 10 mm. The addendum is equal to one module. The larger gear has 40 teeth while the pinion has 20 teeth will the gear interfere with the pinion?