



PILLAI COLLEGE OF ENGINEERING, NEW PANVEL
(Autonomous) (Accredited 'A+' by NAAC)
END SEMESTER EXAMINATION
May 2023

SEM- IV

BRANCH: Mechanical/Automobile Engineering

Subject: - THEORY OF MACHINES AND MECHANISMS

Time: 02.00 Hours

Max. Marks: 60

Date: 04/05/2023

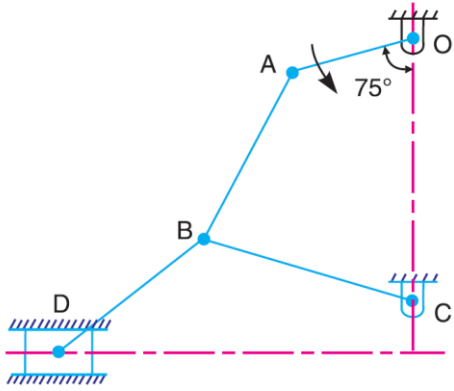
N.B 1. Q.1 is compulsory

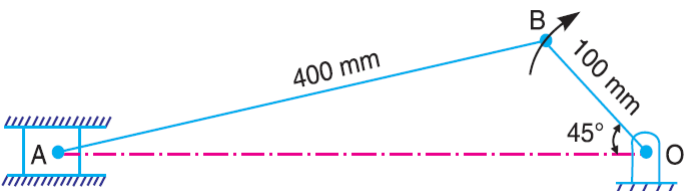
Subject Code ME208/AE209

2. Attempt any two from the remaining three questions

3. Each Question carry 20 marks.

4. Assume suitable data, if necessary

Q.1.	Attempt All	Marks
a)	Explain Interference in Involute Gears and suggest how it may be avoided.	5
b)	A casting weighing 8 kN hangs freely from a rope which makes 2.5 turns round a drum of 290 mm diameter revolving at 18 r.p.m. The other end of the rope is pulled by a man. The coefficient of friction is 0.25. Determine 1. The force required by the man, and 2. The power to raise the casting.	5
c)	How Kutzbach criteria differs from Grubler's criteria? Elaborate with neat diagrams in brief.	5
d)	Two inclined shafts are connected by means of a universal joint. The speed of the driving shaft is 1000 r.p.m. If the total fluctuation of speed of the driven shaft is not to exceed 12.5% of this, what is the maximum possible inclination between the two shafts? With this angle, what will be the maximum acceleration to which the driven shaft is subjected?	5
Q.2.	Attempt All	
a)	In Fig. 1, the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are: OA = 28 mm; AB = 44 mm; BC 49 mm; and BD = 46 mm. The center distance between the centers of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed-point C. The slider moves along a horizontal path and OC is vertical.  Fig. 1	10

b)	The follower moves with simple harmonic motion during ascent while it moves with uniformly accelerated motion during descent with the following details: Least radius of cam = 50 mm; Angle of ascent = 48° ; Angle of dwell between ascent and descent = 42° ; Angle of descent = 60° ; Lift of follower = 40 mm; Diameter of roller = 30 mm; Distance between the line of action of follower and the axis of cam = 20 mm. If the cam rotates at 360 r.p.m. anticlockwise, find the maximum velocity and acceleration of the follower during ascent and descent.	6
c)	Explain the terms: (i) Module, (ii) Pressure angle, and (iii) Addendum.	4
Q.3.	Attempt All	
a)	An open belt drive connects two pulleys 1.2 m and 0.5 m diameter, on parallel shafts 4 m apart. The mass of the belt is 0.9 kg per metre length and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3. The 1.2 m pulley, which is the driver, runs at 200 r.p.m. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 r.p.m. Calculate the torque on each of the two shafts, the power transmitted, and power lost in friction. What is the efficiency of the drive?	10
b)	Locate all the instantaneous centers of the slider crank mechanism as shown in Fig. 2. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: Velocity of the slider A.  Fig. 2	6
c)	Enlist and explain any one approximate straight line motion mechanism in brief.	4
Q.4.	Attempt All	
a)	A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the wheel turns while any pairs of teeth are in contact.	10
b)	Power is transmitted using a V-belt drive. The included angle of V-groove is 30° . The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg per metre length and maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140° . $\mu = 0.15$.	6
c)	Draw the displacement diagram for a cam to raise a valve with simple harmonic motion through 50 mm in $1/3$ of a revolution, keep it fully raised through $1/12$ revolution and to lower it with harmonic motion in $1/6$ revolution. The valve remains closed during the rest of the revolution. The axis of the valve rod passes through the axis of the camshaft.	4