


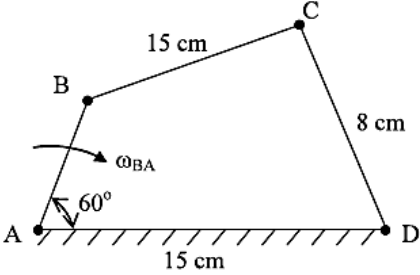
Name: Enrolment No:	
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UPES
End Semester Examination, May 2024

Course: Theory of Machine Program: B.Tech Aerospace Engineering Course Code: MECH 2013	Semester: IV Time : 03 hrs. Max. Marks: 100
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Instructions: State clearly any assumption.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Compare between Machine and Structure.	4	CO1
Q 2	A Linkage has 12 links and the number of loops is 4 Calculate its i) degrees of freedom, ii) number of joints, and iii) maximum number of ternary links that can be had. Assume all the pairs are turning pairs.	4	CO1
Q 3	Classify different types of kinematic pairs.	4	CO1
Q 4	<p>In a four bar chain ABCD link AD is fixed and is 15 cm long. The crank AB is 4 cm long rotates at 160 rpm (clockwise) while link CD rotates about D is 8 cm long BC=AD and angle BAD=60 deg. Find angular velocity of link CD.</p> <div style="text-align: center; padding: 10px;">  </div>	4	CO2
Q 5	Give the relationship between tight side and slack side tensions in terms of coefficient of friction and the angle of contact.	4	CO3

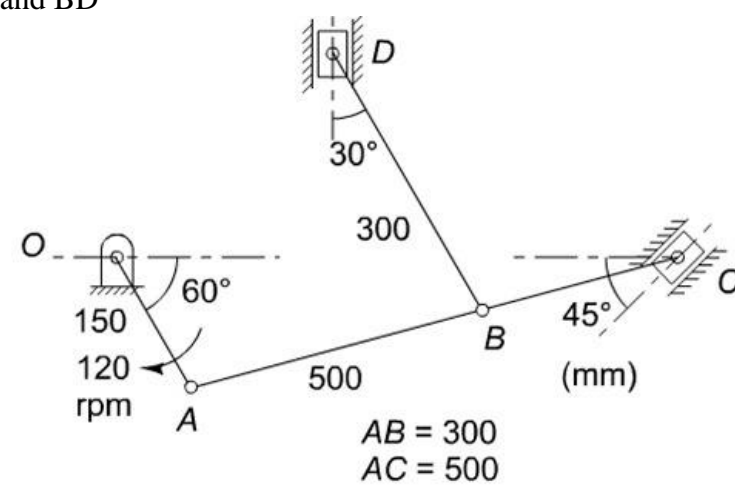
SECTION B
(4Qx10M= 40 Marks)

Q 6	Compare different types of Belt Drives. How many ways power can be transmitted from one pulley to another? Explain briefly with sketches.	10	CO4
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Q 7	Explain the importance of balancing in a rotating element. Discuss the static and dynamic balancing Discuss the different types of gear and their application. List down the 5 potential specific places in an aircraft where gear is used.	10	CO3
Q 8	Derive an expression for displacement, velocity, and acceleration for follower motion when it moves with cycloidal motion, also draw $y-\theta$, $v-\theta$ and $f-\theta$ diagrams, where θ , y , v and f are constant cam rotation, displacement, velocity, and acceleration of follower respectively.	10	CO3
Q 9	A flywheel having mass of 20 kg and a radius of gyration of 300 mm is given a spin of 500 rpm about its axis which is horizontal. The flywheel is suspended at a point 250 mm from the plane of rotation of the flywheel. Find the rate of precession of the wheel.	10	CO4

SECTION-C
(2Qx20M=40 Marks)

Q 10	A cam, with a minimum radius of 25 mm, rotating with a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described as: to raise the valve through 50 mm during 120° rotation of the cam, to keep the valve fully raised through next 30° , to lower the valve during next 60° and to keep the valve closed during rest of the revolution i.e. 150° . The diameter of the roller is 20 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 rpm. Draw the displacement, the velocity and the acceleration diagrams for one complete revolution of the cam.	20	CO4
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Q 11	Solve the above question with Instantaneous center method and find linear velocities of sliders C and D and the angular velocities of links AC and BD  $AB = 300$ $AC = 500$	20	CO2
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OR

For a 4-bar mechanism shown in figure draw velocity and acceleration diagram. All dimensions in mm

