Name : _____ Student ID # : _____

คณะวิศวกรรมศาสตร์
มหาวิทยาลัยสงขลานครินทร์

การสอบกลางภาค ประจำภาคการศึกษาที่ ๑ ประจำปีการศึกษา ๒๕๕๔
วันพุธที่ ๑๒ ตุลาคม พ.ศ. ๒๕๕๔ เวลา ๑๓.๓๐-๑๖.๓๐ น.
วิชา ๒๑๕-๓๒๔ / ๒๑๖-๓๒๔ : กลศาสตร์เครื่องจักรกล ห้องสอบ S817

ทุจริตในการสอบ ปรับขั้นต่ำคือปรับตกในรายวิชาที่ทุจริต และพักการเรียน ๑ ภาคการศึกษา

คำสั่ง

๑. ข้อสอบมีทั้งหมด ๖ ข้อ คะแนนเต็ม ๑๒๐ คะแนน ให้ทำลงในข้อสอบทุกข้อ
๒. อนุญาตให้ใช้เครื่องคิดเลขได้
๓. ให้ใช้เครื่องมือเขียนแบบได้
๔. ไม่อนุญาตเอกสารอื่น ๆ

รศ.ดร. วรวุธ วิสุทธิ์เมธางกูร
ผู้ออกข้อสอบ

ข้อ	*คะแนนเต็ม*	*ได้*
๑	๒๐	
๒	๒๐	
๓	๒๐	
๔	๒๐	
๕	๒๐	
๖	๒๐	
รวม	๑๒๐	

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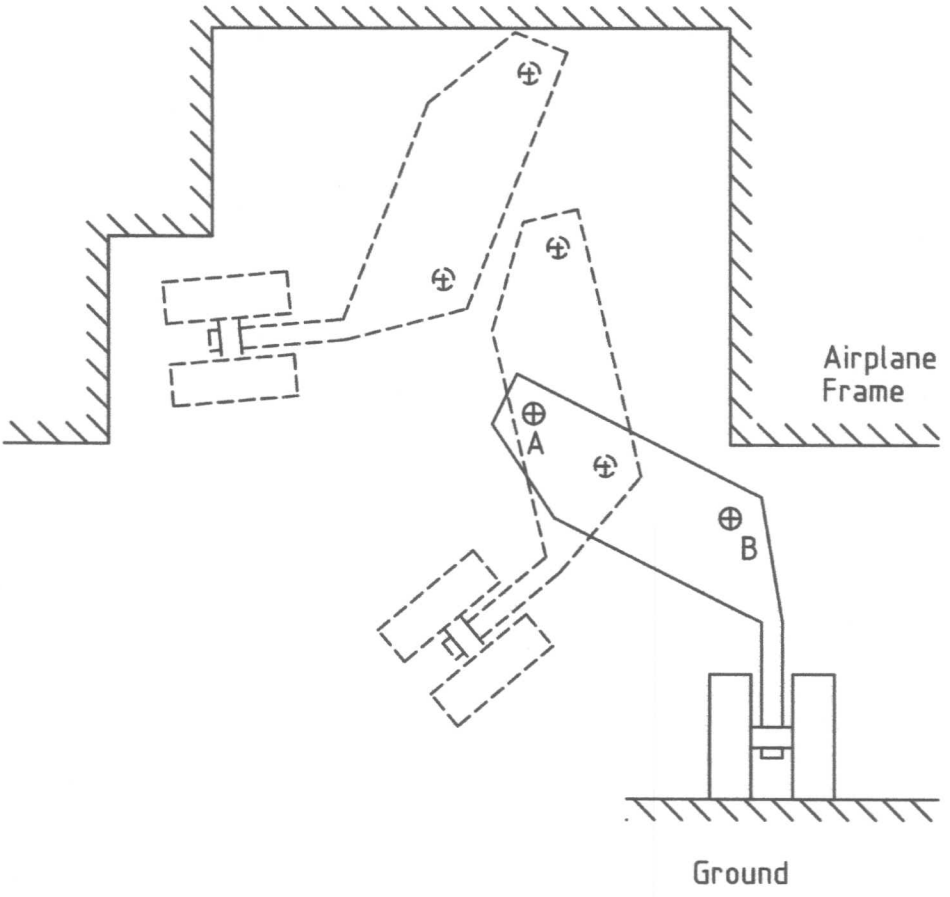
1) The wheels of an airplane are to be stored inside the body to reduce drag during its flight. The figure shows the three positions of the wheel assembly. The engineer must design a four bar linkage to move the wheels assembly through these positions. The wheel assembly can be considered as the coupler link, with the location of the moving pivots at A and B. Use the graphical method to locate the positions of the fixed pivots of mechanism on the frame of the airplane, and draw the other two links of the mechanism, connected to the wheel assembly at its first position.



Of the two links you have added, which link should be the input, and what is the reason ?

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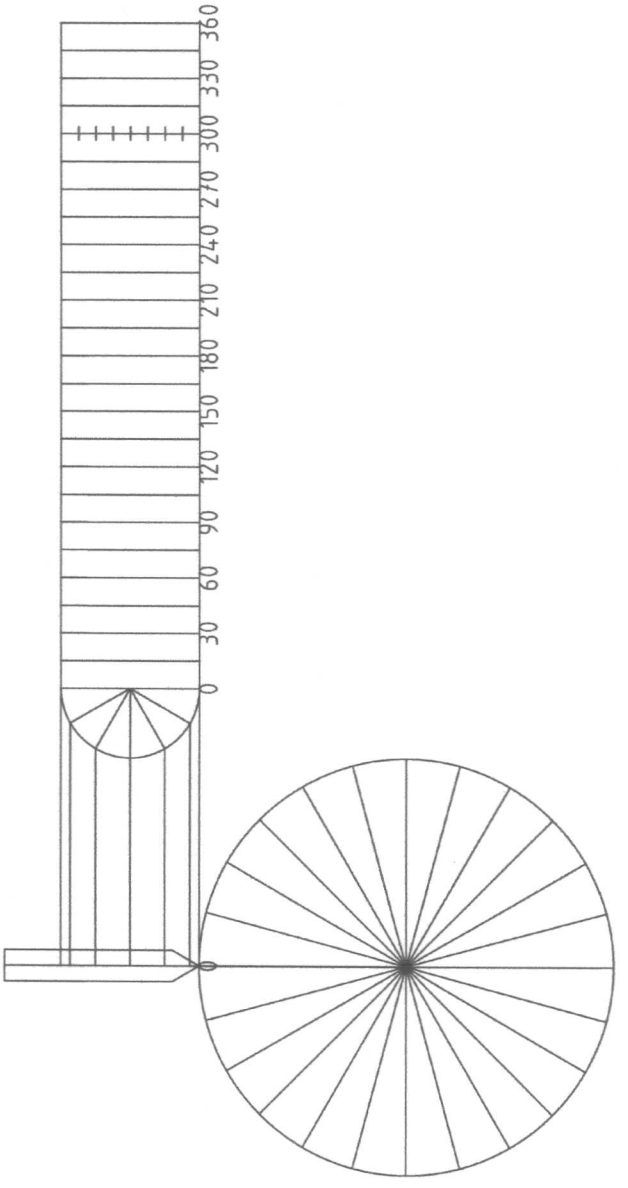
2) The knife-edge follower of a plate cam is to start with a dwell of 60°, then rise 2 cm with simple harmonic motion in 90° of cam rotation, and dwell for 90°, then return with two parabola sections of 60° each. The two parabola sections must joined the adjacent section with a continuous slope. If the radius of the prime circle is 3 cm, draw the displacement diagram, and the cam profile for counterclockwise cam rotation.



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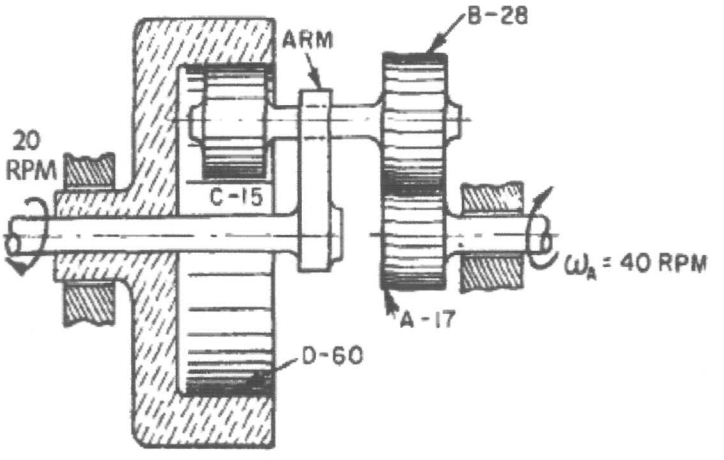
3) This figure shows a compound epicyclic gear train. The tooth numbers are indicated in the figure. The arm is driven CCW at 20 rpm. Gear A is driven CW at 40 rpm. Find the speed of the ring gear D. Use both the formula and the tabular methods to check the answer.



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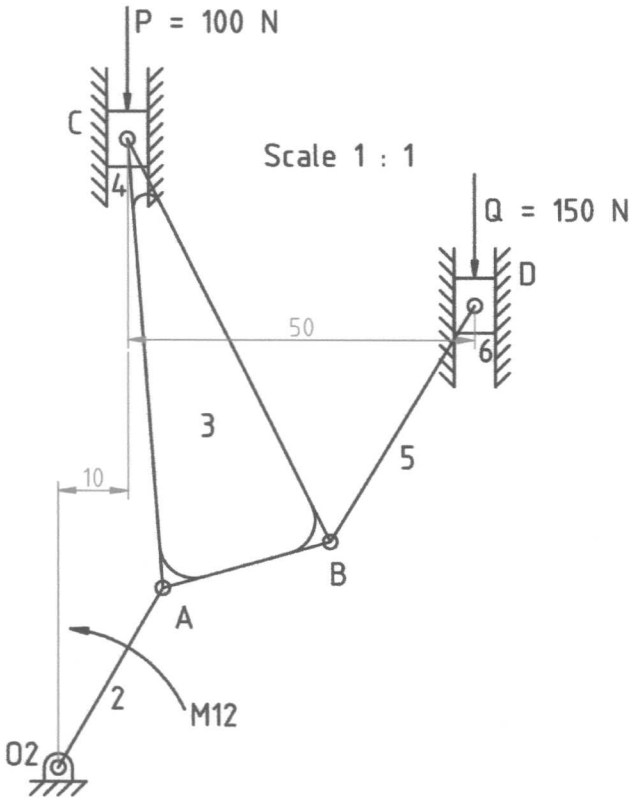
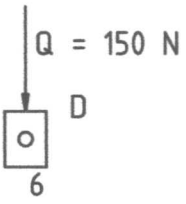
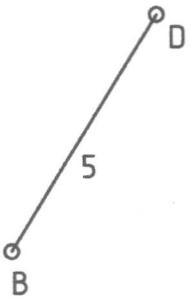
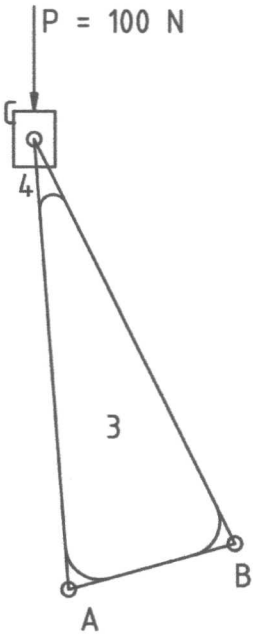
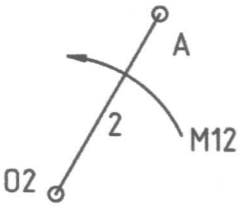
4) The six bar mechanism shown in the figure is applied with P = 100 N at slider 4, and Q = 150 N at slider 6, and is under a static equilibrium. Complete the given free body diagrams of the links by drawing the constraint force at the joints. Also determine the magnitude of moment M12.











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5) For the slider crank mechanism shown on the next page, the crank is driven at a constant speed ω_2 = 20 rad/s CW (α_2 = 0). The following data of each link is given as follows:

m_2 = 1 kg, G_2 is at its fixed pivot (origin of the x-y axes), I_{G2} = 1000 kg.mm^2

m_3 = 0.5 kg, G_3 is at its midpoint between A and B, I_{G3} = 2000 kg.mm^2

m_4 = 0.5 kg, G_4 is at B,

R_{AG2} = 150 mm, and R_{AB} = 200 mm.

The velocity and acceleration polygons are given, along with the incomplete free body diagrams of the links.

(a) Determine the angular acceleration of link 3.

(b) Determine the inertia force on slider 4.

(c) Determine the inertia force and inertia moment on link 3.

(d) Draw the inertia force of links 3 and 4 on the FBD of the links, and determine the constraint forces, F_{14}, and F_{23}.

(e) Complete the free body diagram of link 2, and determine the magnitude and direction of M_{12}.

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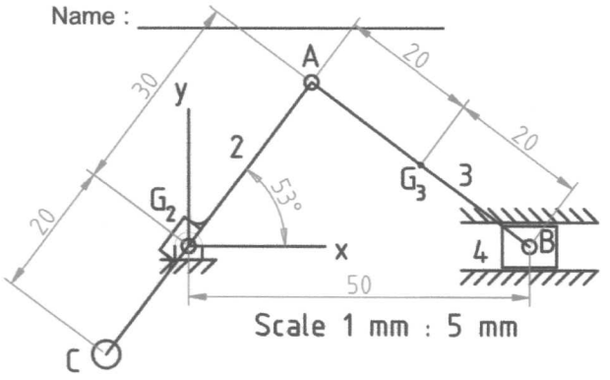

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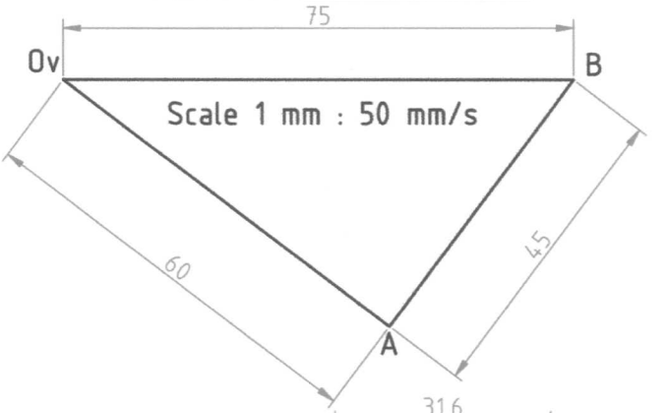
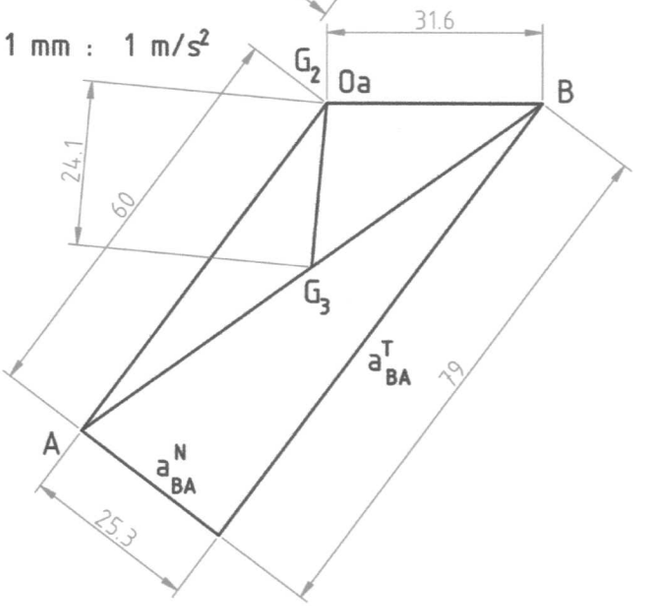
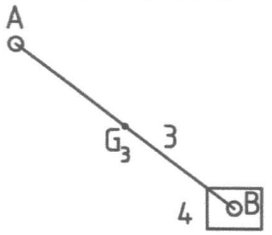
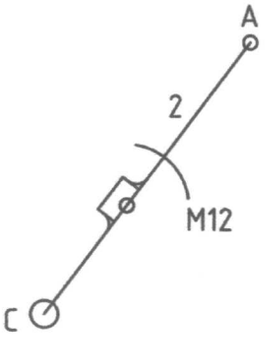


Scale 1 mm : 1 m/s²



Scale 1 mm : 5 mm





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6) The figure shows a system with three masses on different planes of a rotating shaft with the following data: m_1 = 0.1 kg @ 90^O with radius R_1 = 20 mm, m_2 = 0.05 kg @ 300^O with radius R_2 = 30 mm, and m_3 = 0.05 kg @ 210^O with radius R_3 = 20 mm. Determine the magnitudes and angular positions of the balance masses needed to dynamically balance the rotor. The balance masses will be placed in planes 4 and 5 at 15 mm radius.