Number of pages 5
Number of questions 4
Total marks.....100

THE UNIVERSITY OF ADELAIDE
SCHOOL OF MECHANICAL ENGINEERING

EXAMINATION FOR THE DEGREE OF B.E.

MECH ENG 2005: MACHINE DYNAMICS

EXAMINATION - SEMESTER 2, 2002

DURATION: 3 HOURS & 10 MINUTES

[Students are advised to devote 10 minutes to reading the paper and planning their approach.]

[The use of notes, textbooks and calculating devices with the exception of laptop computers is permitted in the examination room.]

Attempt **ALL FOUR** questions.

PLEASE SEE NEXT PAGE

1. In the planetary reduction unit shown in Figure 1, gear 2 turns at 300 rpm in the direction indicated. Determine the angular velocity and direction of rotation of gear 5.

[18 marks]

How many revolutions of gear 2 are required for Arm 6 to complete one full revolution?

[5 marks]

Does Arm 6 rotate in the same direction or in a direction opposite to gear 2?

[2 marks]

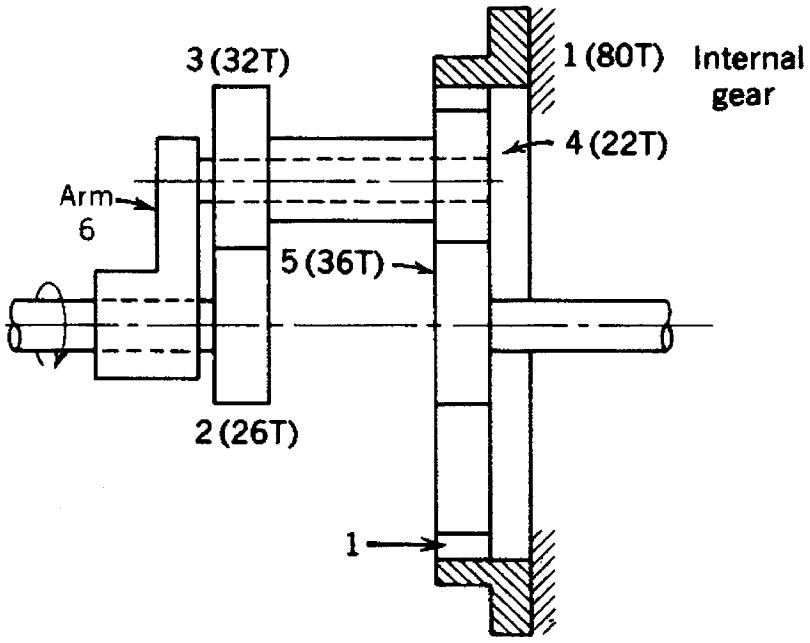

Figure 1

2. Masses m_1 and m_2 of the rotor in Figure 2 rotate in the transverse planes shown. Determine the masses m_3 and m_4 in planes 3 and 4, respectively, which give dynamic rotating balance. Show the correct angular positions of m_3 and m_4.

[25 marks]

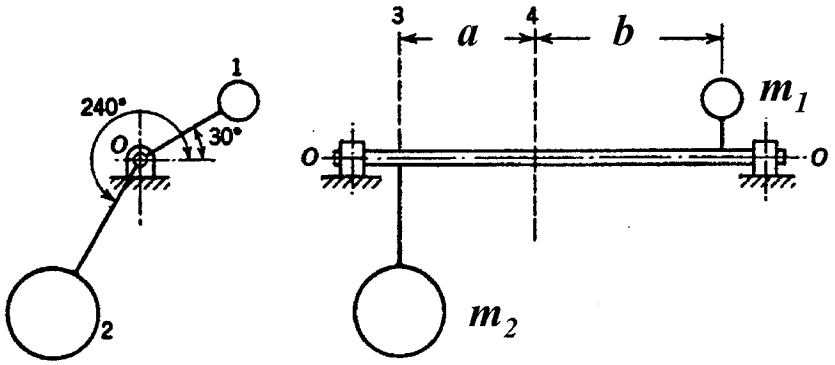

Figure 2

$m_1 = 4$ kg
$m_2 = 10$ kg
$a = 150$ mm
$b = 200$ mm
$r_1 = 125$ mm
$r_2 = 187.5$ mm
$r_3 = 100$ mm
$r_4 = 100$ mm

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3. For the linkage of Figure 3, link 2 rotates at a constant angular velocity. Figure 3 is drawn at $1/10^{th}$ scale. Construct the velocity polygons and graphically compute v_A, v_B and v_C, and the magnitude and direction of ω_3 and ω_4.

[10 marks]

Construct the acceleration polygons and graphically compute a_C and the magnitude and direction of α_3 and α_4.

[15 marks]

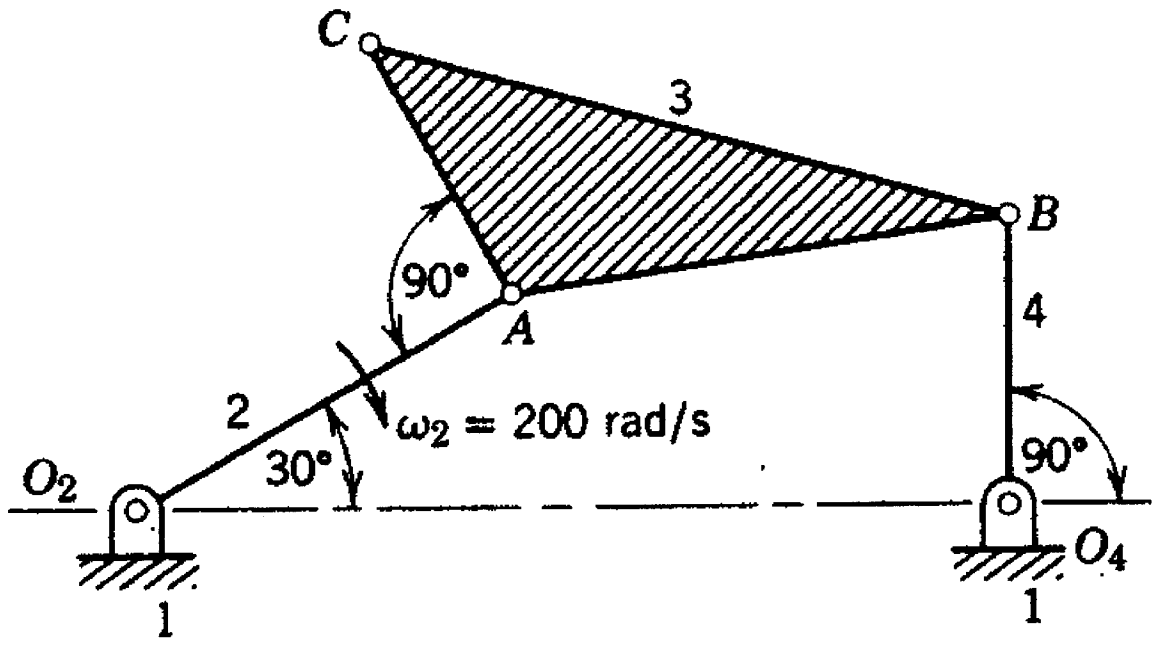

Figure 3

4. For the mechanism shown in Figure 4, determine the magnitudes, directions, senses and locations of the inertia forces acting on links 2, 3, and 4 given that the acceleration of point A is 60 m/s^2 to the right, and the acceleration of point B is 30 m/s^2 downwards. Show the results on a scale drawing of the mechanism. Determine the unknown accelerations graphically.

[15 marks]

Determine the magnitude and direction of the reaction forces at the slider walls at the locations of links 2 and 4. Assume that there is negligible friction and that the influence of gravity on the mechanism is negligible.

[10 marks]

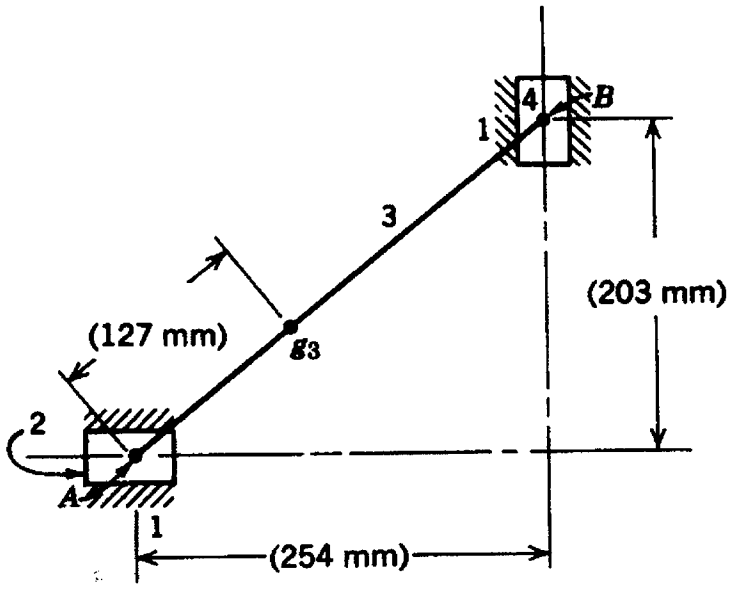

Figure 4

$m_2 = 3$ kg
$m_3 = 5$ kg
$m_4 = 3$ kg
$I_3 = 0.12$ kg m^2

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