

Question: 1

20 % of full mark

The epicyclic gear train consists of gears 3, 4, 5, and 6, as shown in fig.(1), is driven by a simple gear train consists of gears 2 and 3 (*gear 3 belongs to both gear trains*). If given that; $n_2 = + 30 \text{ rpm}$ and $n_{arm} = - 90 \text{ rpm}$, determine for each gear in the gear train :

- The magnitude of angular velocity (in rpm), and
- The direction of rotation of each gear (Include (\pm) sense of rotation).

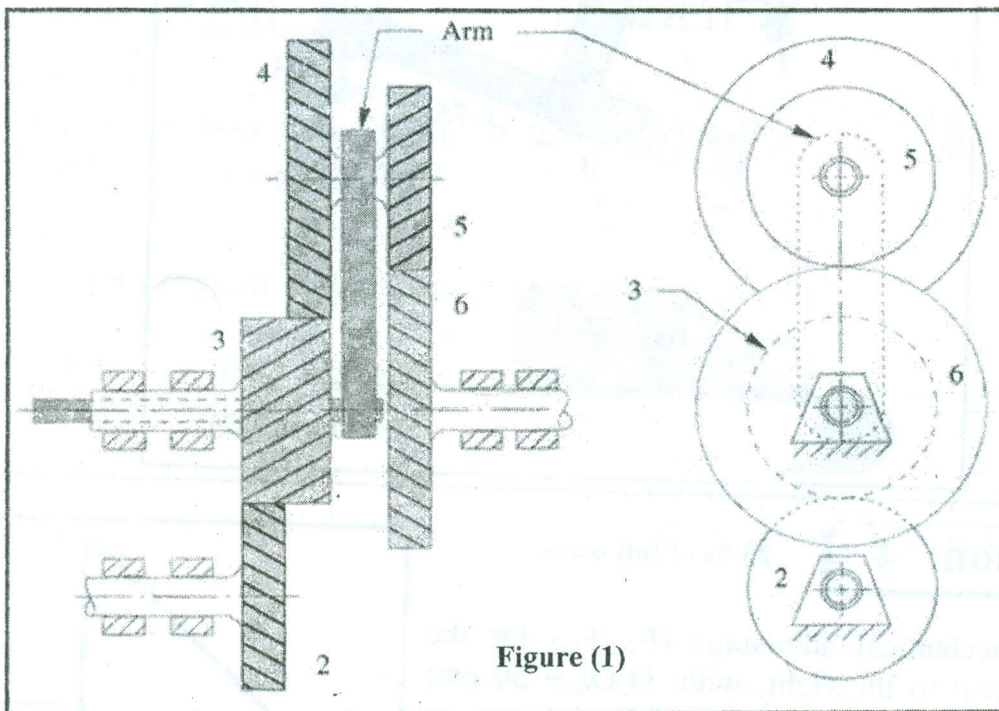


Figure (1)

Question: 2

20 % of full mark

Four masses A , B , C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 4 cm, 5 cm, 6 cm and 3 cm. The angular position of the masses B , C , and D are 60° , 135° and 270° from the mass A .

Find the magnitude and position of the balancing mass at a radius of 10 cm.

Question: 3

40 % of full mark

The mechanism shown in Figure (2), is used to stamp cartons as they pass on a conveyor belt. The driver link O_2A rotates counterclockwise, with angular velocity of 3.14 rad/sec and angular acceleration of 6 rad/sec^2 .

- Is there any Coriolis acceleration in this problem ? (Y / N)
- Determine the angular velocities and angular accelerations of links AB, and B O_4 .
- Determine the absolute velocity and acceleration of the stamp (point X).

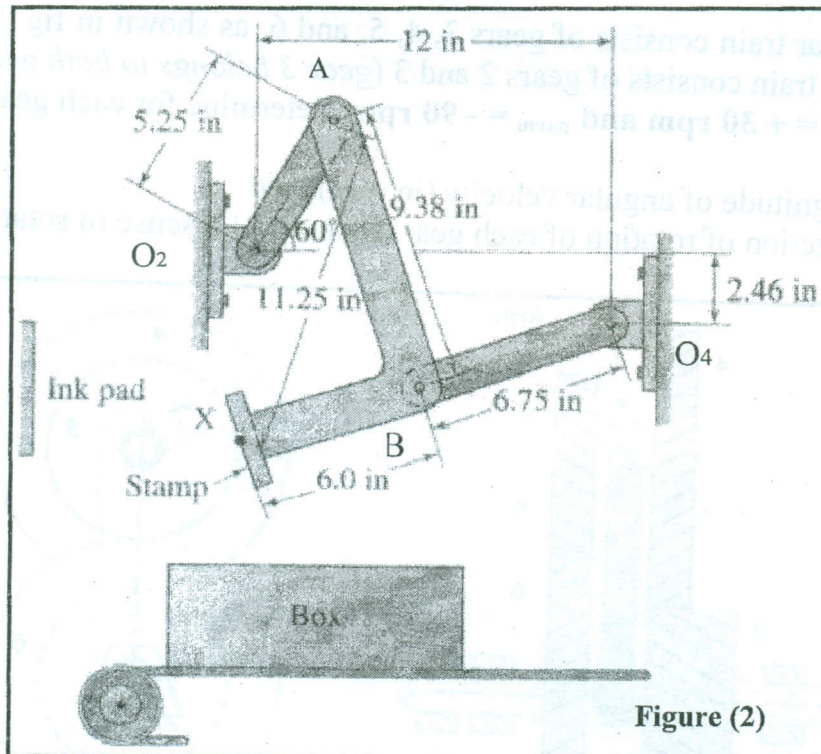


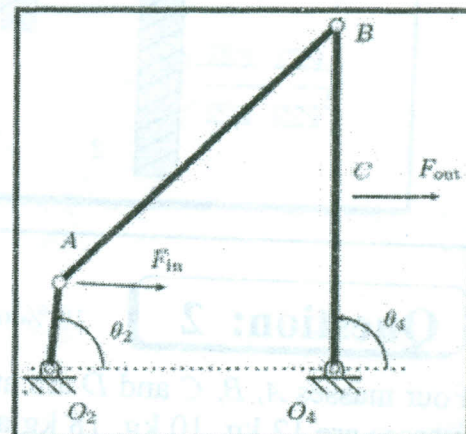
Figure (2)

Question: 4

25 % of full mark

Find the mechanical advantage (F_{out}/F_{in}) for the linkage shown to the right, with: $O_2O_4 = 50 \text{ cm}$; $O_2A = 20 \text{ cm}$; $AB = 70 \text{ cm}$; $BO_4 = 70 \text{ cm}$:

The input force acts at the pin joint and is always perpendicular to link 2 while the output force acts midway along link 4 and is perpendicular to link 4.



With my Best Wishes and Good Luck for you &

Dr. Samy El-Gayyar