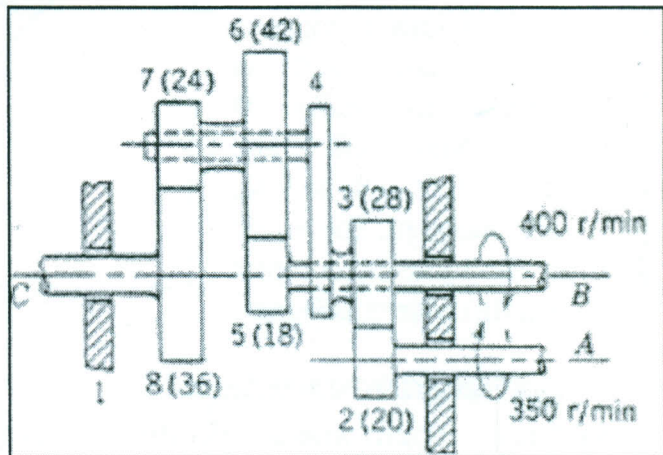


THEORY OF MACHINES

Question: 1 (15 Marks)

Figure (1) illustrates a planetary gear train used in an industrial application. Input shafts *A* and *B* rotate at 350 and 400 rpm (revolutions per minute) in the directions shown. **Determine :**

- The speed and direction of rotation of output shaft *C*.
- The magnitude (in rpm), and the direction (\pm sense of rotation) of angular rotation of each gear.

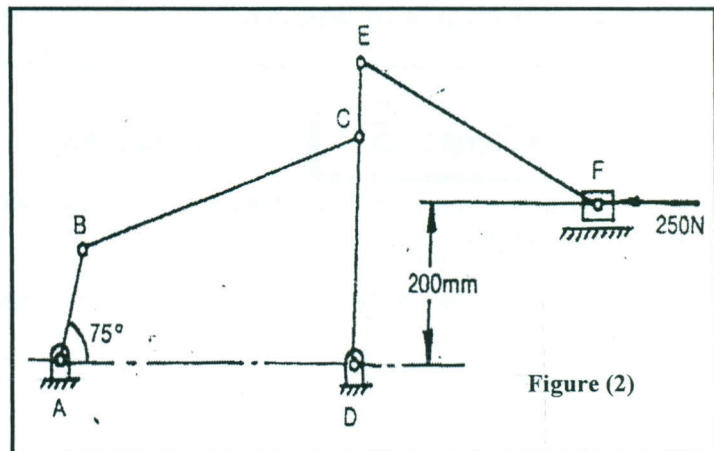


Question: 2 (15 Marks)

For the static equilibrium of the mechanism of Fig. (2),

find the required input torque. The dimensions are:

- AB = 150 mm,
- BC = AF = 500 mm,
- DC = 300 mm,
- CE = 100 mm and
- EF = 450mm.



Question: 3 (15 Marks)

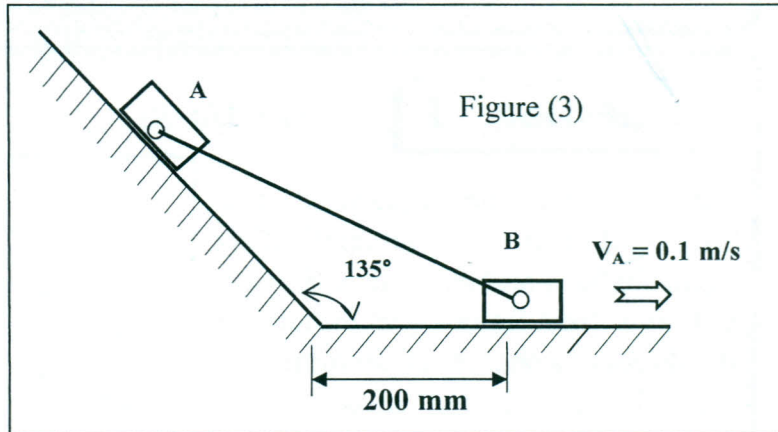
A, B, C and D are four masses carried by a rotating shaft at radii of 10 cm, 13.5 cm, 20 cm and 15 cm respectively. The planes in which the masses revolve are spaced 60 cm apart and the weights of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required **mass A** and the **relative angular setting** of the four masses so that the shaft is in complete balance.

Question: 4

(20 Marks)

In the mechanism shown in figure (3):

Slider B has an *uniform velocity* equal to 100 mm/s, to the right (as indicated by the arrow), Slider A slides along the inclined plane, and is connected to slider B through link AB. The length of link AB is 1 m. At this moment, the slider B far from the fixed center O by a distance = 200 mm.



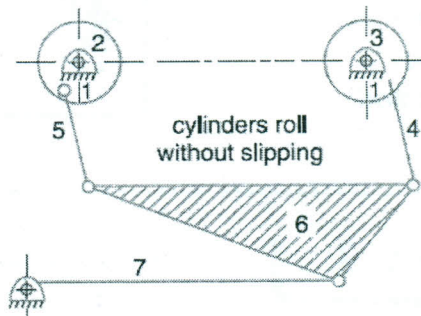
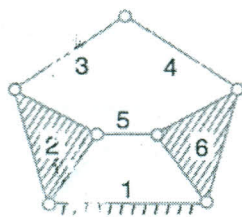
Using graphical diagrams method.:

- Draw velocity and acceleration diagrams to suitable scales.
- Find the magnitude and direction of linear velocity and acceleration of slider A
- Find the magnitude and direction of angular velocity ω , and angular acceleration α of link AB.

Question: 5

(6 Marks)

- What is a machine?, and what are the differences between machine and structure? - Give an example. (3 Marks)
- Determine the degree of freedom of the following mechanisms: (3 Marks)



Figures (4 & 5)

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Note: The exam full mark = 70 marks only

With my Best Wishes for You &

Dr. SAMY EL-GAYYAR