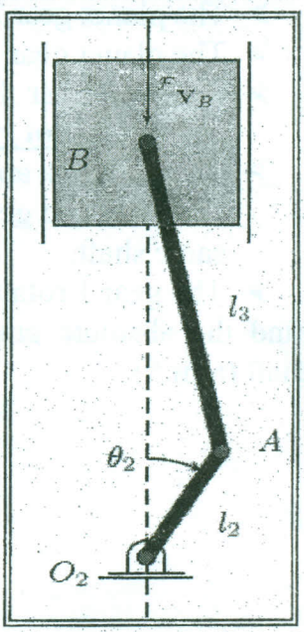
El-Mansoura University		**Mech. Power Engg. Depart.**
Faculty of Engineering	**THEORY OF MACHINES**	**Second Year**
Time Allow. : 3 Hours		**Acad. Year : 2008/ 2009**

Question: 1



At the instant shown, the crank of the piston is at an angle of $\theta_2 = 30°$ and the **constant velocity** of the piston ***B*** is $V_B = 1.1$ m/s (downward). If $L_2 = 15$ cm and $L_3 = 45$ cm, find:

a) the displacement of the piston (point B) from its maximum height;

b) the angular velocity of the crank (link 2); and of the connecting rod (link 3).

b) the angular acceleration of the crank (link 2); and of the connecting rod (link 3).

d) the resulting turning moment (T_2) acting on crank O_2A

Question: 2

For the mechanism shown in Fig. (2), the crank AB inclined by $\varphi = 120°$, and rotates with constant angular velocity ω_{10} equals 1 rad./sec (CCW).

The lengths of links are:
$AB = 100$ mm, $BC = 450$ mm,
$ED = 450$ mm, $EC = 250$ mm.

Find ;

(a) The linear velocity and acceleration of slider ***F,*** (magnitude and direction) and

(b) The angular velocity and the angular acceleration of link ***DE***.

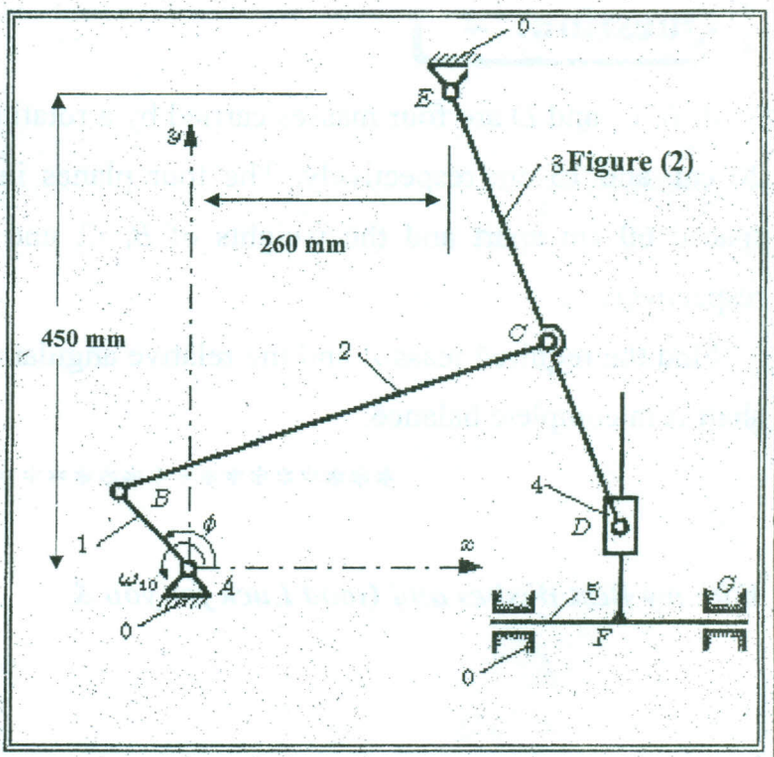


Figure (2)

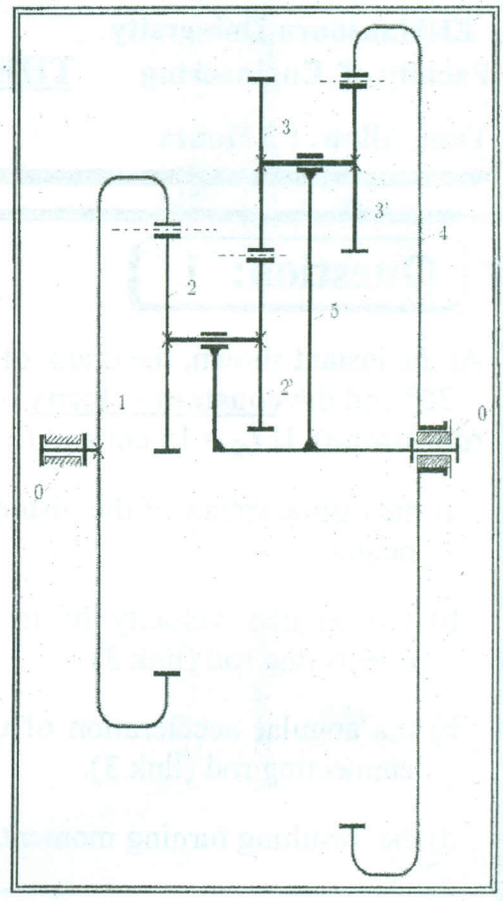
Question: 3

A planetary gear train is shown in Fig. (2).

- The ring gear 1 has 68 internal gear teeth,
- The planet gear 2 has 28 external gear teeth,
- The planet gear 2' has 24 external gear teeth,
- The planet gear 3 has 20 internal gear teeth,
- The ring gear 4 has 100 internal gear teeth and **fixed (not rotate).**
- The gears 2 and 2' are fixed on the same shaft and the gears 3 and 3' are fixed on the same shaft.
- The gear 1 rotates with 200 rpm (cw).

Find the absolute angular velocity of the output shaft (arm 5).

Gear	No. of teeth
1	68
2	28
2'	24
3	20
3'	16



Question: 4

A, B, C, and *D* are four masses carried by a rotating shaft at radii 10 cm, 12.5 cm, 20 cm, and 15 cm respectively. The four 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 masses so that the shaft is in complete balance.

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With my Best Wishes and Good Luck for you &

Dr.\ Samy El-Gayyar