Menoufia University *Faculty of Engineering, Shebin El-kom* *Production Engineering Department* *First Semester Exam. 2014 - 2015* *Date of Exam: 4 / 1 / 2015*	Menoufia University	*Subject: Theory of Machines* *Code: (PRE213)* *Year: Second Year* *Time Allowed : 3 Hours* *Total Marks: 100 marks*

Assume any required data and illustrate the answer by net sketches.

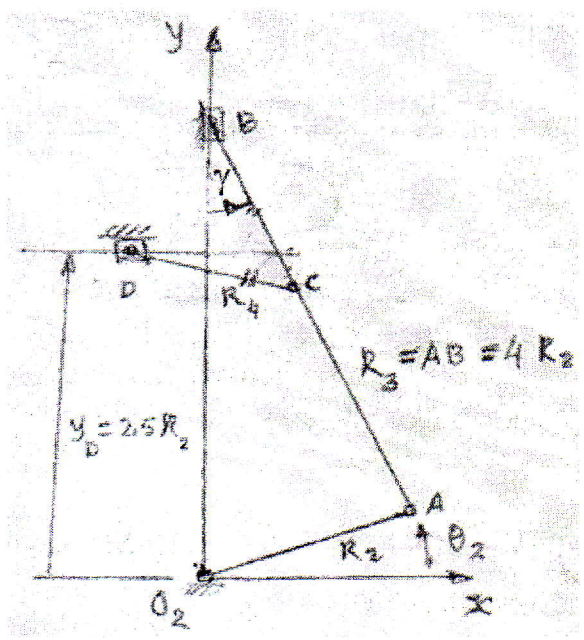
Answer the following questions:

Question 1 (50 Marks):

Data: Fig. (1) and Fig. (2).

Required:

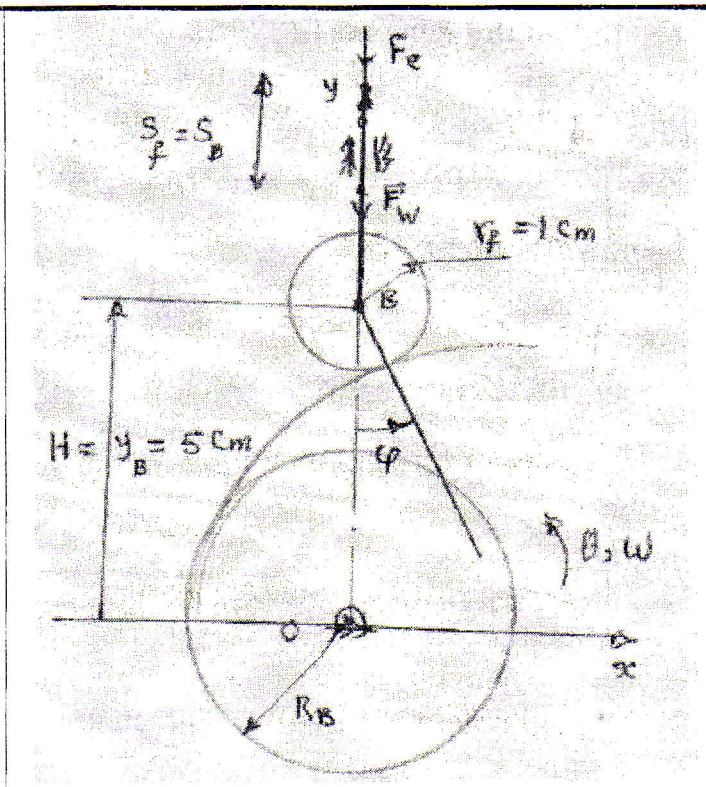
1. Illustrate and define R_n, θ_n, γ or ϕ on each figure. (4 Marks)
2. Find N_f, T_R, R_2, S_t of B, γ or ϕ and name for each figure. (6 Marks)
3. Determine S_t of D (Fig. 1) and at $\theta_2 = 0$. Find T_d due to F_{id}. (22 Marks)
4. Compute F_t (Fig. 2) considering $S_i = 2$ cm, $K = 5$ N/cm, $F_e = 1.5$ N, $F_w = 2$ N. Is separation phenomenon is existed? Why? (18 Marks)



$R_4 = B_C = 1.5\ R_2$

$y_{Bmin} = 9$ cm, $\omega_2 = c = 120$ rad/min.

Fig. (1)



$S_{tB} = L$, $\beta_r = \beta_t = \beta = \pi$, $\theta = 0.5\ \pi$

$R_2 = R_B$

$S_B = S_f = 0.5\ L\ [1 - \cos(\pi\theta / \beta)]$

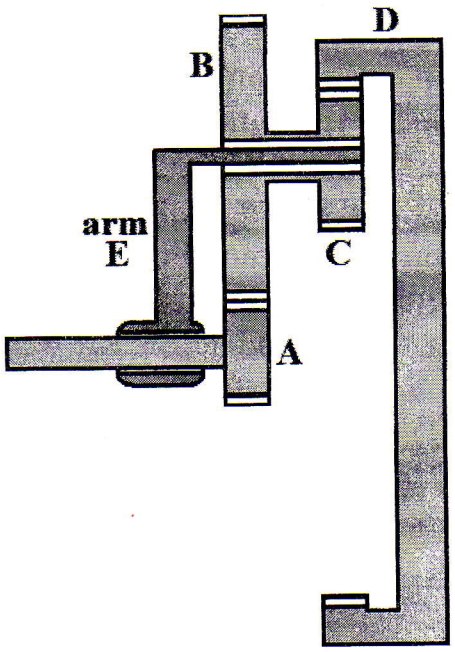
$H_{max} = y_{Bmax} = 6$ cm.

Fig. (2)

باقى الأسئلة خلف الورقة

Question 2 (20 Marks):

A reverted epicyclic gear train for a hoist block is shown in Fig. 1. The arm *E* is keyed to the same shaft as the load drum and the wheel *A* is keyed to a second shaft which carries a chain wheel, the chain being operated by hand. The two shafts have common axis but can rotate independently. The wheels *B* and *C* are compound and rotate together on a pin carried at the end of arm *E*. The wheel *D* has internal teeth and is fixed to the outer casing of the block so that it does not rotate. The wheels *A* and *B* have 16 and 36 teeth respectively with a module of 3 mm. The wheels *C* and *D* have a module of 4 mm.



Find:

- The number of teeth on wheels *C* and *D* when the speed of *A* is ten times the speed of arm *E*, both rotating in the same sense. (15 Marks)
- The speed of wheel *D* when the wheel *A* is fixed and the arm *E* rotates at 450 rpm anticlockwise. (5 Marks)

Question 3 (30 Marks):

A multi-cylinder engine is to run at a speed of 600 rpm. On drawing the turning moment diagram to a scale of 1 mm = 250 N-m and 1 mm = 3°, the areas above and below the mean torque line in mm^2 are : + 160, – 172, + 168, – 191, + 197, – 162. The speed is to be kept within ±1% of the mean speed of the engine. The density of the cast iron is 7250 kg/m^3 and its hoop stress is 6 Mega Pascal. Assume that the rim contributes 92% of the flywheel effect.

Calculate:

1. Moment of inertia of the flywheel (I). (10 Marks)
2. Mean diameter of the flywheel. (D) (10 Marks)
3. Mass of the flywheel rim. (m) (5 Marks)
4. The suitable dimensions of a rectangular flywheel rim if the breadth is twice its thickness. (b and t) (5 Marks)

Best Wishes