Menoufiya University
Faculty of Engineering
Shebin El-Kom
First Semester Final Exam
Academic Year: 2015-2016
Date: 10/1/2016

Year:2nd year
Department:Prod. Engineering
Subject: Theory of Machines
Course Code:PRE213
Time Allowed: 3 hours
Full Mark : 100 marks

Assume any required data and use neat sketches
Solve All Questions:

Question (1) (25 Marks)

Data: Offset C-S mechanism and offset radial cam-roller follower mechanism in condition that,

$r_2 = 3e = 0.5\ R_3 = 3$ cm, $\theta_1 = 0.5\pi$ for the 1st mechanism and that, $r_b = 2e = 4\ r_f = (4/3)\ L = 4$cm, $\omega = 3.14$ rad/s (R.H.D.), time of stroke $t_r = t_t = 1$sec. for the 2nd mechanism.

Req: 1. Compare between these mechanisms.
2. Find H_o, H_{max}, T_R and ϕ or γ for each mechanism.
3. Draw the cam profile if $S_f = 0.5\ L[1 - \cos(\pi\theta/\beta)]$

Question (2) (25 Marks)

(A) Construct C-R and C-C mechanisms so that $\gamma_{min} = 45^o$ and $r_4 = 8$ cm. Compare between these mechanisms.

(B) **Data:** In fig. 1 $O_2A = 15$ cm, $O_2O_4 = 24$ cm, $O_4C = 16.5$ cm, CD = 43 cm and ω_{in} = const. = 2.5 rad/s (R.H.D.)

Req: 1. Is this mechanism? Why?
What is the mechanism name? why?
2. Find S_t of the ram (slider) D, max. length of O_4A and time ratio.
3. Compute S_d, F_{id}, v_{rub} at pin joint C and T_d due to F_{icd} at crank (O_2A) position $\theta_2 = 315^o$.

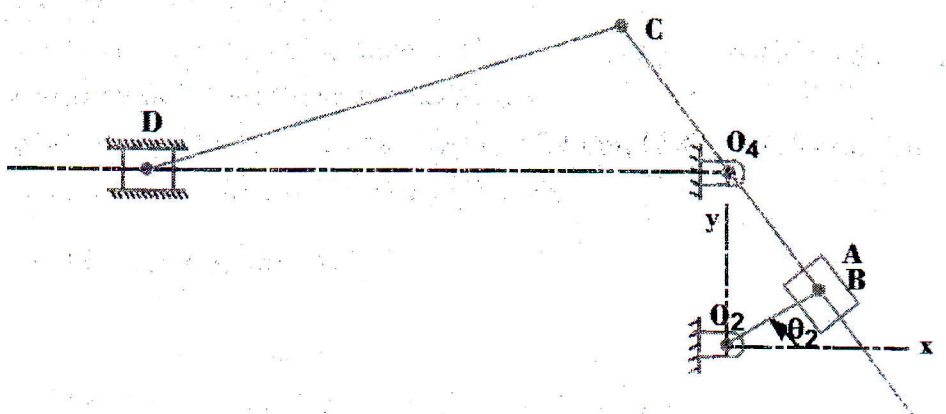

Fig. 1

Question (3) (25 Marks)

Fig. 2 shows some details of a compound epicyclic gear drive where I is the driving or input shaft and O is the driven or output shaft which carries two arms A and B rigidly fixed to it. The arms carry planet wheels C and D which mesh with annular wheels P and Q and the sun-wheels X and Y. The sun wheel X is a part of Q. Wheels Y and Z are fixed to the shaft I. Z engages with a planet wheel E carried on Q and this planet wheel engages the fixed annular wheel R. The numbers of teeth on the wheels are :
P = 144, Q = 120, E = 45, C = 54, Y = 24 and Z = 30 teeth.
The driving shaft I makes 1500 rpm Counterclockwise.

Calculate:

1. **The number of teeth of gears X, D and R.**
2. **The speed and direction of rotation of the driven shaft O and the wheel P.**

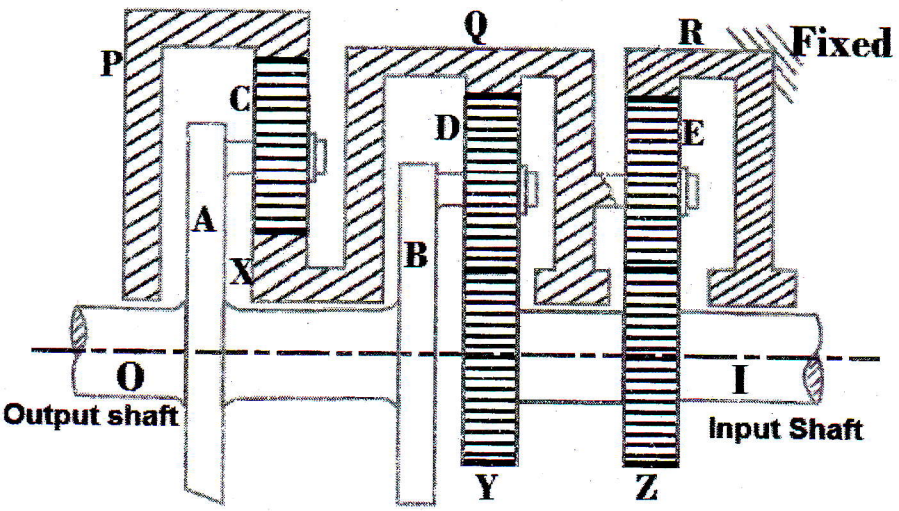

Fig. 2

Question (4) (25 Marks)

A, B, C and D are four masses carried by a rotating shaft at radii 100 mm, 150 mm, 150 mm and 200 mm respectively. The planes in which the masses rotate are spaced at 500 mm apart and the magnitude of the masses B, C and D are 9 kg, 5 kg and 4 kg respectively.
Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.

Best wishes