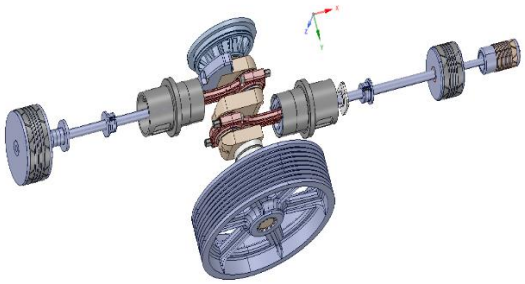
Yildiz Technical University, Department of Mechanical Engineering

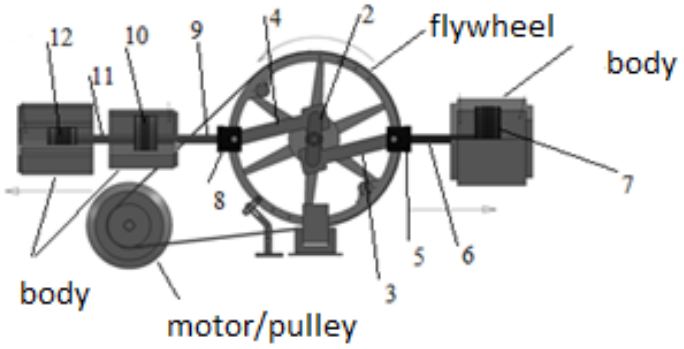
MACHINE DYNAMICS

Homework, May 8, 2019

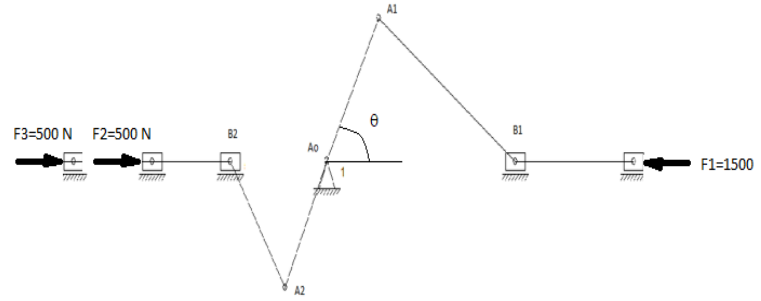
Name Surname		Signature	
Student Number		Group Number	

QUESTION 1





2	crank
3	connecting rod for 1st stage
4	connecting rod for 2nd stage
5	cross head for 1st stage
6	piston rod for 1st stage
7	piston for 1st stage
8	cross head for 2nd and 3rd stages
9	piston rod for 2nd stage
10	piston for 2nd stage
11	piston rod for 3rd stage
12	piston for 3rd stage



For each connecting rod: Mconnecting rod=36 kg	Mcrank=250 kg
For each cross head: Mcross head=17 kg	Mpiston (1st stage)=40 kg
For each piston rod: Mpiston rod=22 kg	Mpiston (2nd stage)=20 kg
$I_{motor\text{-}pulley}$=6.5 kgm^2 i=2.7 $I_{flywheel}$=100 kgm^2 r_{crank}=120 mm $l_{connecting\ rod}$=480 mm For velocity of the piston: $x = r\cos\theta + (L(1-\frac{r^2}{2L^2}\sin^2\theta)$ where **r** is **crank rod** and **L** is the **connecting rod**.	Mpiston (3rd stage)=10 kg

For the given multistage comprosser,

a) Obtain the dynamic equivalent model of the system by performing ***mass reduction*** by considering ***2 or 3 substantional points*** for each link.

b) Find the ***reduced mass moment of inertia*** to motor shaft?

c) Obtain the **equation of motion** of the system.

Note: The bars are homogenous and center of mass of each link is the midpoint.

Roadmap: 1. Reduce the each stage to crankpin (The reduced mass to point A) **2.** Write the reduced mass moment of inertia to flywheel shaft and motor shaft, respectively.

QUESTION 2)

For the given position of the mechanism; determine the required **tork** for **static equilibrium** of the system by considering the acting static forces **F_1 , F_2 and F_3** by ignoring the inertia forces. Use the kinamatic figure by scaling.