ME 581 – C04 **Name ________________________**

1) Plot the crank torque required to drive the web cutter at constant crank speed 60 rpm CCW through one full revolution of the crank. Assume that the mechanism operates in a vertical plane, that there are no external forces on the mechanism other than the weight of the links, and that friction is negligible. Neglect cutting forces.

2) What are the bearing reactions and crank torque for part 1) when ϕ_2 = 85.5 degrees?

T_{1on2} ________________ F_{1on2} (________, _______)^T F_{2on3} (________, _______)^T

F_{3on4} (________, _______)^T F_{1on4} (________, _______)^T

3) Assume that the crank of the web cutter is rotating at constant crank speed 60 rpm CCW when the crank motor power is suddenly cut at ϕ_2 = 85.5°. Determine the acceleration of the crank at the moment when crank torque is cut to zero, and predict crank angle and crank speed at h = 0.05 seconds later.

use $\{q\}_{NEW} = \{q\}_{OLD} + \{\dot{q}\}_{OLD} h + 0.5\{\ddot{q}\}_{OLD} h^2$ and $\{\dot{q}\}_{NEW} = \{\dot{q}\}_{OLD} + \{\ddot{q}\}_{OLD} h$

$\ddot{\phi}_2$ ______________ $\dot{\phi}_2$ at h later ______________ ϕ_2 at h later ______________

4) Check the kinematic consistency of your $\{q\}_{NEW}$ and $\{\dot{q}\}_{NEW}$ predicted at h later.

max abs $\{\Phi\}$ ___________________ max abs $\lfloor \Phi_q \rfloor \{\dot{q}\}$ ___________________

EXTRA CREDIT

Determine the STATIC crank torque and bearing reactions at ϕ_2 = 85.5° required to produce 10 N vertical cutting force between cutters P and Q of the web cutter. Assume there are no external forces on the mechanism other than the vertical cutting forces. Assume that friction is negligible. Do not include the weight of the links. Do not include dynamic effects.

T_{1on2} ________________ F_{1on2} (________, _______)^T F_{2on3} (________, _______)^T

F_{3on4} (________, _______)^T F_{1on4} (________, _______)^T

EXTRA EXTRA CREDIT

Use velocities and virtual work to determine STATIC crank torque at ϕ_2 = 85.5° per above.

T_{1on2} ________________