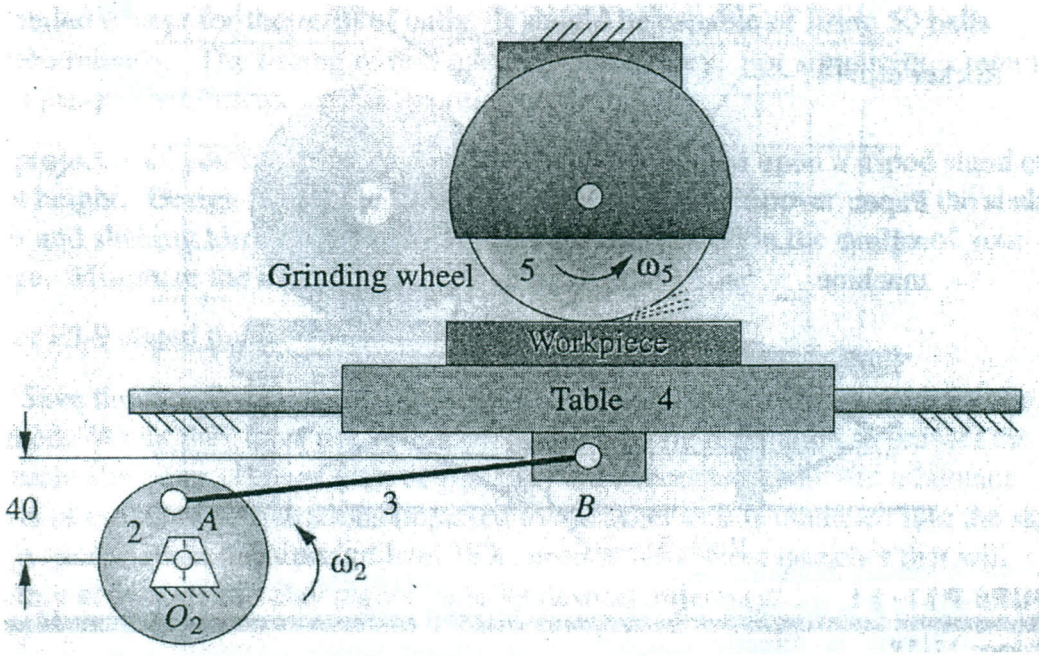
Mansoura University		Theory of Machines
Faculty of Engineering		Final-Exam Fall 2012
Prod. Eng. & Mech. Design Dept.		Time: 3 hours

(Open Book Exam)

Please attempt the following questions:

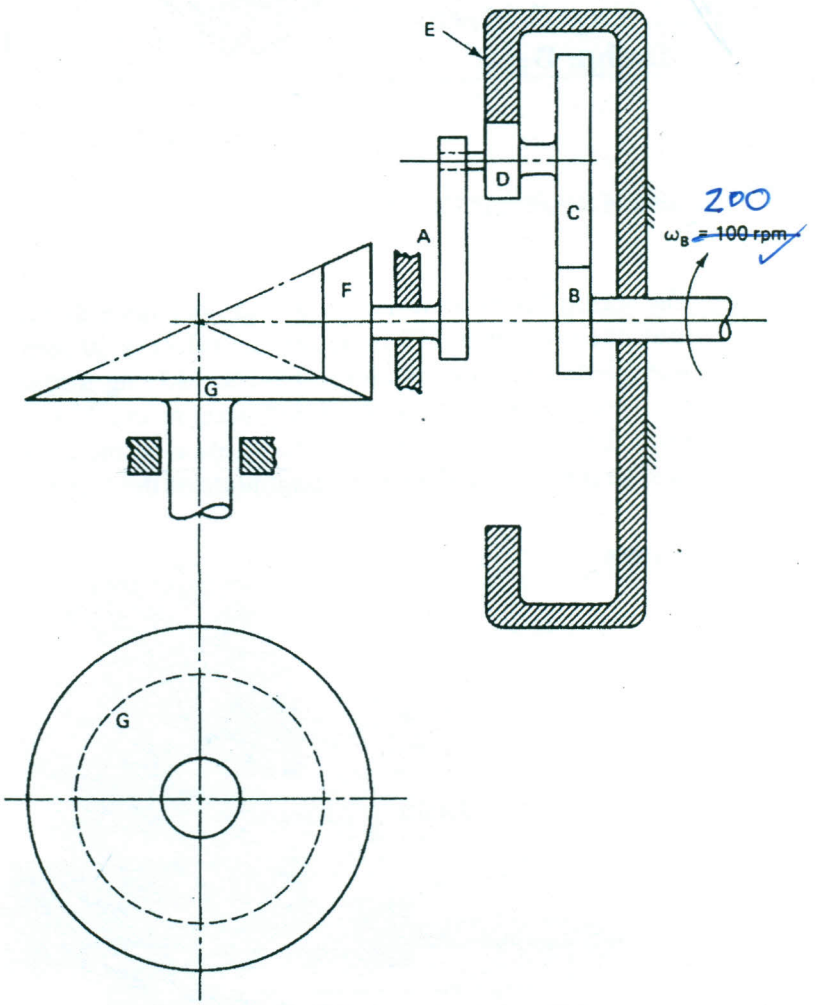
1. The figure below shows a surface grinder table drive. The crank radius is **22 mm**, the coupler is **157 mm**, and the offset is **40 mm**. The mass of table and workpiece combined is **50 kg**. Find the driving torque of the crank necessary to overcome the inertia of sliding parts at crank angle equals **90°** measured from the horizontal line. The acceleration of the slider at that position is **0.5 m/s^2** to the left. Find also the magnitude of the force at the crank pivot, O_2.



2. Determine a suitable base circle radius and the equations of the cam profile assuming that the translating flat-faced follower starts from a dwell from ***0°*** to ***160°***. The rise occurs with cycloidal motion during the cam rotation from ***160°*** to ***270°***. The fall then occurs with cycloidal motion for the cam rotation from ***270°*** to ***360°***. The amplitude of the follower translation is ***10 cm***. The cam rotates in the clockwise direction.

3. The sun gear ***B*** of the figure shown below rotates at ***200 rpm*** **CW** as viewed from the right. Determine the angular velocity and direction of ω_G as viewed from bottom.

A = arm
B = 24 teeth
C = 60 teeth
D = 18 teeth
E = 102 teeth (fixed)
F = 25 teeth
G = 50 teeth



4. A certain machine requires a torque of (***1410+200 sin θ***) ***lb-ft*** to drive it, where θ is the angle of rotation of the shaft measured from some datum. The machine is directly coupled to an engine which produces a torque of (***1410+250 sin θ***) ***lb-ft***. The flywheel and other rotating parts attached to the shaft weigh ***750 lb*** with radius of gyration of ***18 in***. The mean speed is ***70 rpm***. Determine:

   a) The power of the engine.
   b) The percentage fluctuation of the speed.
   c) The maximum angular acceleration of the flywheel.

5. The rotor shown below has unbalanced weights $w_1 = 0.13$ *lb*, $w_2 = 0.2$ *lb*, and $w_3 = 0.13$ *lb*, at radial positions $r_1 = 4$ *in*, $r_2 = 3$ *in*, and $r_3 = 2$ *in*. Determine the necessary counterweight correction amounts and locations in balance planes at locations P and Q for complete static and dynamic balance of the rotor.