Final exam UE PS29

- Durée : 2h. No Documents are allowed.
- Clarity of the expression and care brought into the writing will be accounted for in the evaluation. **Any negligence or unreadability of the exam sheet will be sanctioned by a null mark to the associated question.**
- **Unjustified answers** will be ignored.

Nom	Prénom	Signature

PARTIE 1. GENERAL VECTOR OPERATIONS

1. Calculate the coordinates of the orthogonal projection H of a point M(x,y,z) on the line D (see figure 1). The line D passes through the origin O and has $\vec{V}$ as direction vector. Apply the result to the case where $\vec{V}$ has (1,1,2) as components in the reference basis. (**2pts**)

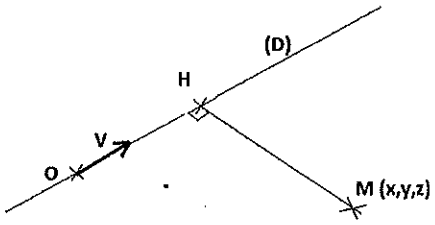

Fig. 1

PARTIE 2. KINETICS

A system of distinct masses A(2m), B(m) and C(m) is coplanar.

1. Determine geometrically the mass center of the system (**2pts**)
2. Compute using two different methods, the coordinates of the mass center of the following planar geometry composed of a disc of radius ***R*** with a hole of radius ***r***. the eccentricity of the centers is ***e*** (Fig. 2) (**4pts**):

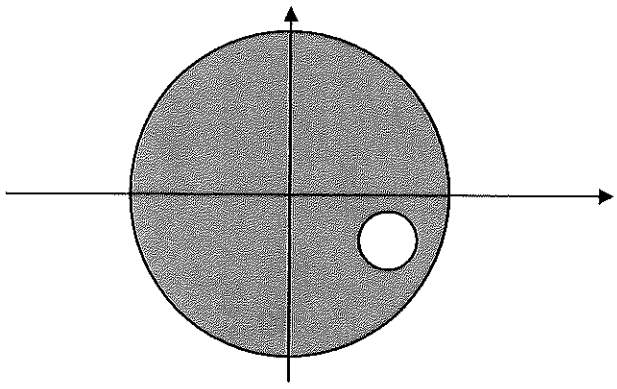

Fig. 2

See verso

3. The system rotates around the origin of the reference system with an angular velocity of $\dot{\theta}$. Calculate the kinetic and dynamic resultants (**2pts**).

PARTIE 3. KINEMATICS, KINETICS AND DYNAMICS

An eccentric cam mechanism consists of two rigid parts: the first part is a cam of radius R, which rotates with a constant velocity ω about a fixed-point O. An eccentricity of e is the distance between the center of the cam and the origin O. The second part is a follower who is subjected to a translation motion only along Y axis. The follower has flat surfaces perpendicular to its motion. A permanent contact exists between the follower and the cam. The mechanical system is presented in Fig. 3(a).

1. Find the velocity and acceleration of the follower. (**2pts**)
2. Determine the lower and upper displacement of the follower and plot its trajectory with respect to time. (**2pts**)
3. We will assume that the pivot joint in O, is a hole of radius r. Derive the kinetic and the dynamic resultants of the cam. (**2pts**)
4. Find the velocity and acceleration of the follower when it is inclined to the horizontal at a constant angle α (Fig. 3(b)). (**4pts**)

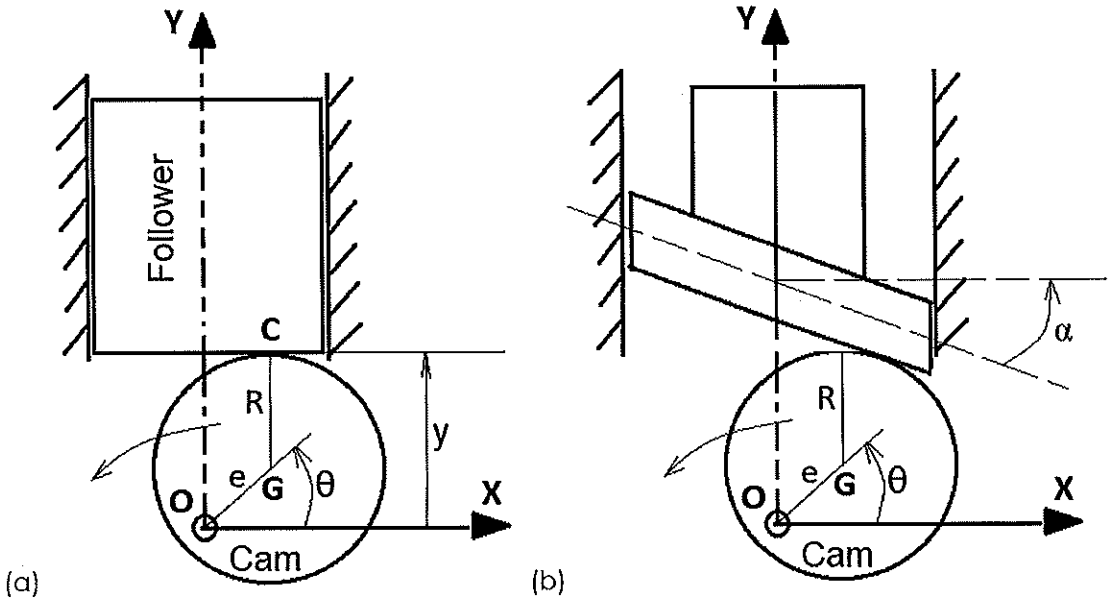

Fig. 3

Nom : Prenom :