

1. A thin, uniform rod of mass  $m$ , length  $L$  lies in the  $xy$  plane with its center at the origin. If the rod makes an angle  $\alpha$  with the positive  $x$  axis, as shown in Fig. 1, calculate 3 moments of inertia by integration method with respect to this Cartesian system ( $x$ ,  $y$ , and  $z$  axes). (15%)

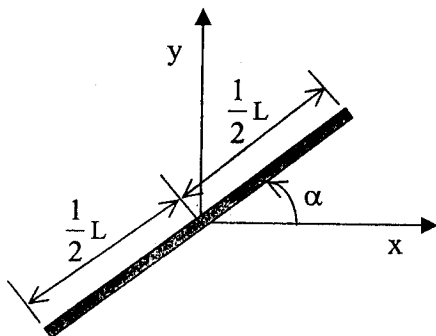


Fig. 1

2. Two disks, each of radius  $r$ , roll without slipping on each other and on the floor, as shown in Fig. 2. Assume that the angular rates  $\Omega$  and  $\omega$  are constant, and  $\omega = \dot{\theta}$ .

- (a) Find  $\dot{\phi}$  as a function of  $\Omega$  and  $\omega$ . (8%)  
 (b) Find the acceleration of point  $p$ . (17%)

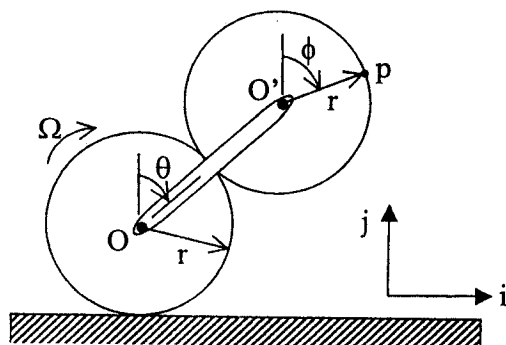


Fig. 2