

國立臺北科技大學

九十三年學年度自動化科技研究所入學考試

工程力學試題

填准考證號碼

第一頁 共二頁

--	--	--	--	--	--	--	--	--	--

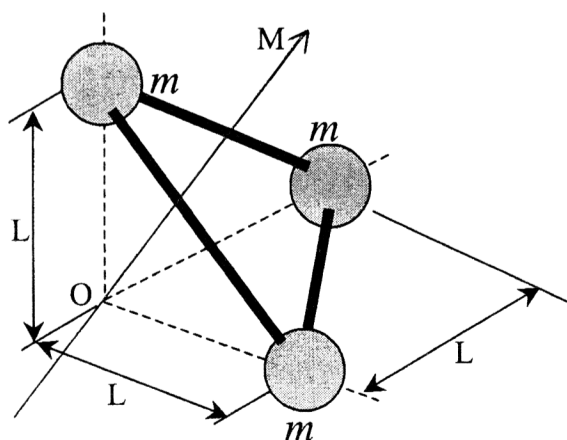
注意事項：

1. 本試題共五題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

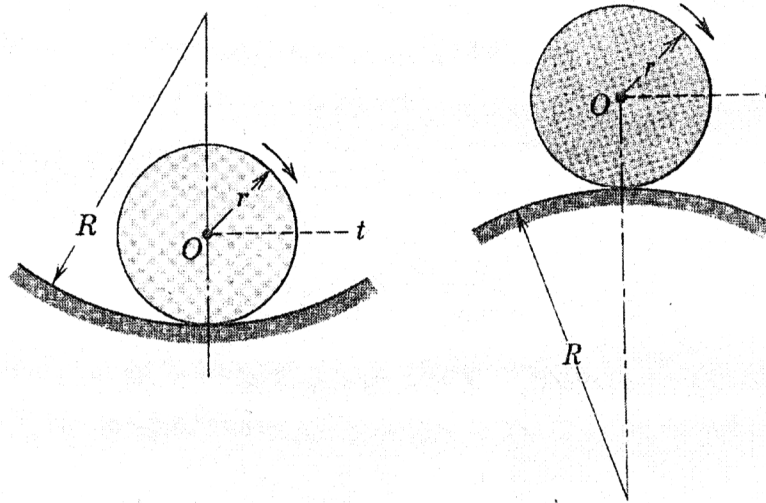
1. Prove that the moment of inertia of the rigid assembly of three identical balls, each of mass m and radius r , has the same value for all axes through O and is independent of the axis vector λ . (20%)

(Neglect the mass of the connecting rods. Note that the moment of inertia about any axis OM with a unit vector

$(\lambda = l\vec{i} + m\vec{j} + n\vec{k})$ can be expressed as $I_{OM} = I_{xx}l^2 + I_{yy}m^2 + I_{zz}n^2 - 2I_{xy}lm - 2I_{xz}ln - 2I_{yz}mn$).

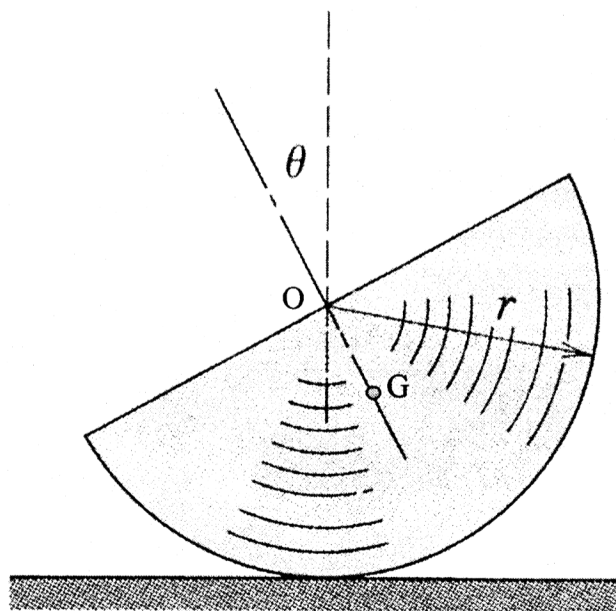


2. Derive and prove that the expressions $v_t = r\omega$ (velocity) and $a_t = r\alpha$ (acceleration) hold for the motion of the center O of the wheel which rolls on the concave or convex circular arc, where ω and α are the absolute angular velocity and acceleration, respectively, of the wheel. Assume that no slipping occurs between the wheel and the circular track. (20%)

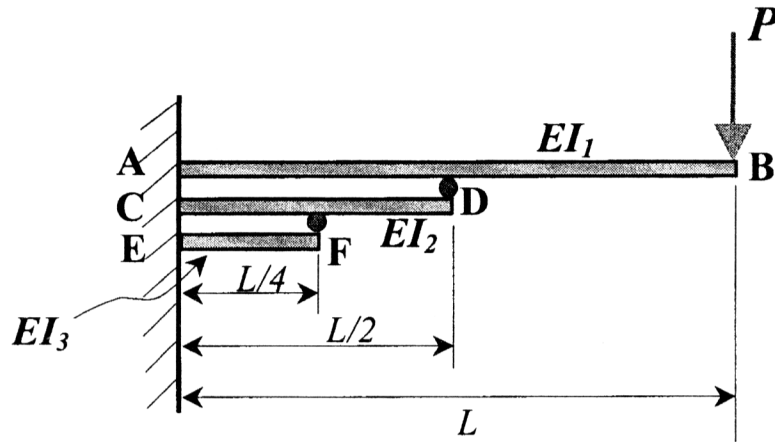


3. The homogeneous solid semicylinder is released from rest in the position shown. Determine the maximum angular velocity ω reached by the cylinder as it rolls on the horizontal surface. Assume that no slipping occurs between the semicylinder and the ground. (20%)

(Note that the distance between the gravity center G and Point O is $\frac{4r}{3\pi}$)



4. Three cantilever beams AB, CD and EF are supported as shown in the following figure. Two rollers fit perfectly between the three beams at point D and F, respectively. The flexural rigidity of Beam AB, CD and EF are EI_1 , EI_2 and EI_3 , respectively. Determine the force transmitted between the beams at F. (20%)



5. A thin semicircular bar AB of radius R and constant flexural rigidity EI is supported and located as shown in the following figure. Determine the horizontal deflection δ_b of Point B. (20%)

