考试教室 姓名 学号 年级 专业、班 学院

公平竞争、诚实守信、严肃考纪、拒绝作弊

密 封 线

重庆大学《Kinematics and Kinetics》课程试卷

◉A卷 ○B卷

2016 —2017 学年 第 一 学期

开课学院：机械工程学院 课程号：ME30821 考试日期：

考试方式：○开卷 ◉闭卷 ○其他 考试时间：120 分钟

题号	一	二	三	四	五	六	七	八	九	十	总 分
得分											

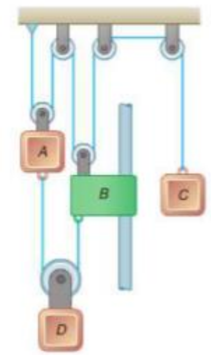
考试提示

1.严禁随身携带通讯工具等电子设备参加考试；

2.考试作弊，留校察看，毕业当年不授学位；请人代考、替他人考试、两次及以上作弊等，属严重作弊，开除学籍。

一、（20 分）

The system shown starts from rest, and each component moves with a constant acceleration. If the relative acceleration of block C with respect to collar B is 60 mm/s² upward and the relative acceleration of block D with respect to block A is 110 mm/s² downward, determine (a) the velocity of block C after 3s, (b) the change in position of block D after 5 s.



Positive direction Downward

$2x_A + 2x_B + x_C = const$

$x_D - x_A + x_D - x_B = const$

$a_C - a_B = 60$

$a_D - a_A = -110$

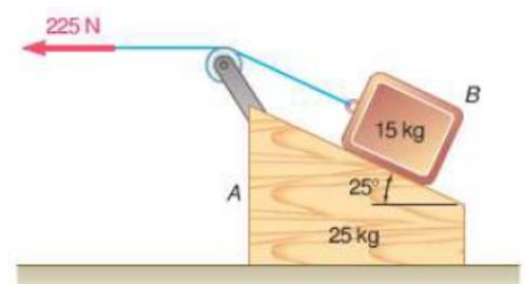
$a_B = -100mm/s^2 \quad a_A = 120mm/s^2 \quad a_C = -40mm/s^2 \quad a_D = 10mm/s^2$

$v_C = v_0 + a_C t = -120mm/s$

$\Delta x_D = \frac{1}{2} a_D t^2 = 125mm$

二、（20 分）

The 15-kg block B is supported by the 25-kg block A and is attached to a cord to which a 225-N horizontal force is applied as shown. Neglecting friction, determine (a) the acceleration of block A, (b) the acceleration of block B relative to A.



命题人：刘怀举

组题人：刘怀举

审题人：宋朝省

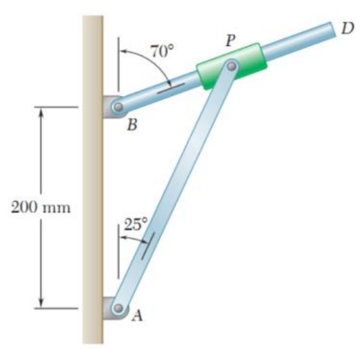
命题时间：2015年12月10日

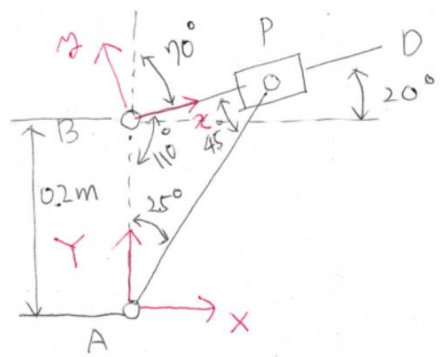
教务处制

三、（20 分）

Knowing that at the instant shown the rod attached at A has an angular velocity of 5 rad/s counterclockwise and an angular acceleration of 2 rad/s^2 clockwise. Determine the angular velocity and the angular acceleration of the rod attached at B. 15.176

(note: $\frac{\overline{AB}}{\sin 45°}=\frac{\overline{AP}}{\sin 110°}=\frac{\overline{BP}}{\sin 25°}$**)**





$\overline{AP}=0.2658m, \overline{BP}=0.1195m$

$\vec{\omega}_{AP}=5rad/s\vec{k} \quad \vec{\alpha}_{AP}=-2rad/s^2\vec{k}$

$$\vec{v}_p=\vec{\omega}_{AP}\times\vec{r}_{P/A}=5\vec{k}\times(\overline{AP}\sin 25°\vec{i}+\overline{AP}\cos 25°\vec{j})$$
$$=5\vec{k}\times(0.1123\vec{i}+0.2409\vec{j})=-1.2044\vec{i}+0.5616\vec{j}(m/s)$$

$$\vec{a}_P=\vec{\alpha}_{AP}\times\vec{r}_{P/A}+\vec{\omega}_{AP}\times(\vec{\omega}_{AP}\times\vec{r}_{P/A})$$
$$=-2.326\vec{i}-6.247\vec{j}(m/s^2)$$

Velocity:

$$\vec{v}_P=\vec{v}_B+\vec{\omega}_{BD}\times\vec{r}_{D/B}+(\dot{\vec{r}}_{D/B})_{BD}$$

$$\vec{\omega}_{BD}\times\vec{r}_{D/B}=\omega_{BD}\vec{k}\times(\overline{BD}\cos 20°\vec{i}+\overline{BD}\sin 20°\vec{j})$$

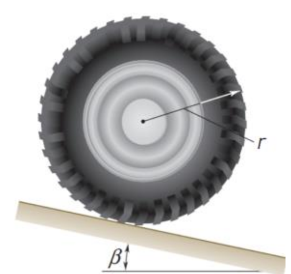
$$(\dot{\vec{r}}_{D/B})_{BD}=u\vec{i}=u\cos 20°\vec{i}+u\sin 20°\vec{j}$$

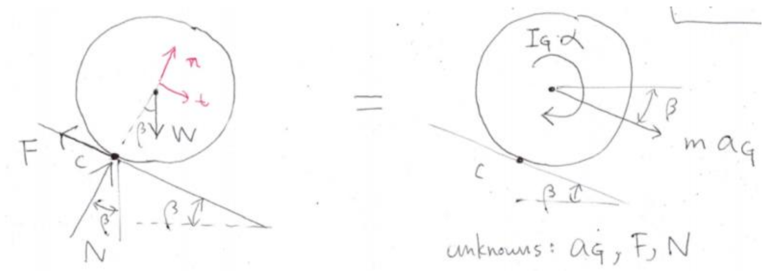
$$\vec{v}_P=(-0.04088\,\omega_{BD}+0.9397u)\vec{i}+(0.1123\omega_{BD}+0.342u)\vec{j}$$

$$\omega_{BD}=7.861(rad/s)$$
$$u=-0.9397(m/s)$$

四、（20 分）

A wheel of radius r and centroidal radius of gyration k is released from rest on the incline and rolls without sliding. Derive an expression for the acceleration of the center of the wheel in terms of r,k,β,g. (The rotation inertia of the wheel is express as $I_G=mk^2$. 17.70





$I_G = mk_G^2$

$\sum F_t = W\sin\beta - F = ma_G$
$\sum F_N = N - W\cos\beta = 0$
$\sum M_c = -W\sin\beta \times r = -I_G\alpha - ma_G r$

$\alpha = \dfrac{rg\sin\beta}{k_G^2 + r^2}$

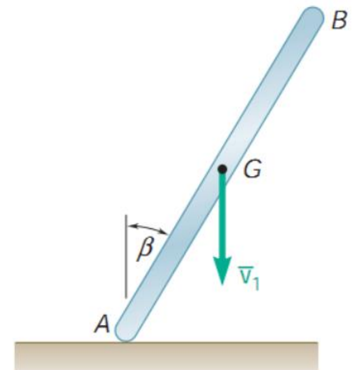
$a_G = r\alpha = \dfrac{r^2 g\sin\beta}{k_G^2 + r^2}$

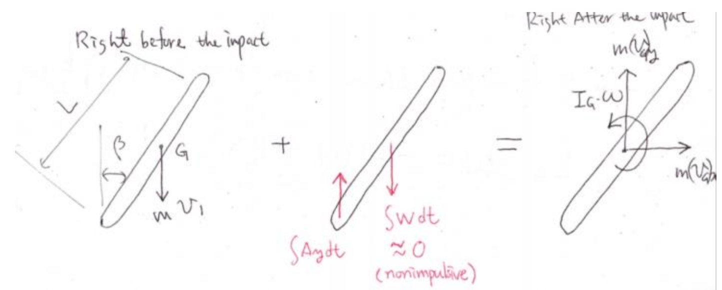
If μ_s is given

$F_s \le \mu_s N$ must be checked.

五、（20 分）

The slender rod Ab of length L=1m forms an angle $\beta = 30°$ with the vertical as it strikes the frictionless surface shown with a vertical velocity $\bar{v}_1 = 2$ m/s and no angular velocity. Knowing that the coefficient of restitution between the rod and the groud is $e = 0.8$, determine the angular velocity of the rod immediately after the impact. (The impulsive effect caused by the gravity is negligible) 17.113





X: $0+0 = m(v_G)_x \to (v_G)_x = 0$

Y: $-mv_1 + \int A_y dt = m(v_G)_y$

Moment about A: $-(mv_1)\dfrac{L}{2}\sin\beta = I_G\omega + m(v_G)_y\dfrac{L}{2}\sin\beta$

$e = \dfrac{v_{Ay} - 0}{0 - (-v_1)} \to v_{Ay} = ev_1$

$\vec{v}_G = \vec{v}_A + \omega\vec{k} \times \vec{r}_{G/A} = (v_{Ax}\vec{i} + ev_1\vec{j}) + \omega\vec{k} \times (\dfrac{L}{2}\sin\beta\vec{i} + \dfrac{L}{2}\cos\beta\vec{j})$

$\vec{v}_G = (v_{Ax} - \dfrac{L}{2}\omega\cos\beta)\vec{i} + (ev_1 + \dfrac{L}{2}\omega\sin\beta)\vec{j}$

$$\begin{cases} (v_G)_x = v_{Ax} - \dfrac{L}{2}\omega\cos\beta = 0 \\ (v_G)_y = ev_1 + \dfrac{L}{2}\omega\sin\beta \end{cases}$$

$$-mv_1\frac{L}{2}\sin\beta = I_G\omega + m(ev_1 + \frac{L}{2}\omega\sin\beta)\frac{L}{2}\sin\beta$$

$$\rightarrow \omega = -6.1714(rad/s)$$