# 國立虎尾科技大學 102 學年度第一學期博士班資格考試題

所別：動力機械工程系機械與機電工程博士班　　第 1 頁　共 1 頁

科目：動力學

注意事項：

（1）本試題共有 5 題，每題 20 分，合計一百分。Closed book

（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。

（3）使用計算機

1. A car moves in a straight line such that for a short time its velocity is defined by $v = (9t^2 + 2t)$ ft/s, where t is in seconds. Determine its position and acceleration when t = 3 s. When t=0, s=0.
2. A ball is thrown from a position 5 ft above the ground to the roof of a 40 ft high building, as shown in Fig.1. If the initial velocity of the ball is 70 ft/s, inclined at an angle 60º from the horizontal, determine the range or horizontal distance R from the point where the ball is thrown to where it strikes the roof.
3. The rod OA, shown in Fig. 2, is rotating in the horizontal plane such that $\theta=(t^3)$ rad. At the same time, the collar B is sliding outward along OA so that $r=(100t^2)$ mm. If in both cases t is in seconds, determine the velocity and acceleration of the collar when t=1 s.
4. The smooth 2 kg cylinder C in Fig. 3 has a peg P through its center which passes through the slot in arm OA. If the arm rotates in the vertical plane at a constant rate $\dot{\theta}$=0.5 rad/s, determine the force that the arm exerts on the peg at the instant θ=60º.
5. The 50 lb wheel shown in Fig.4 has a radius of gyration kG = 0.7 ft. If a 35 lb·ft couple moment is applied to the wheel, determine the acceleration of its mass center G. The coefficients of static and kinematic friction between the wheel and the plane at A are $\mu_s$ = 0.3 and $\mu_k$ = 0.25, respectively.

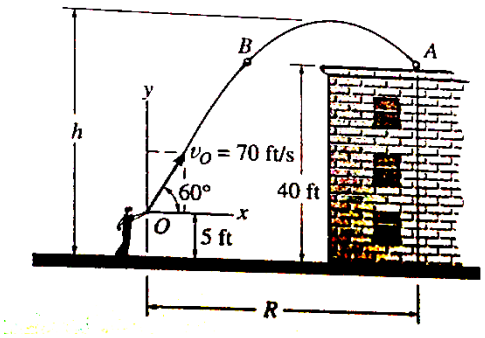



Figure 1

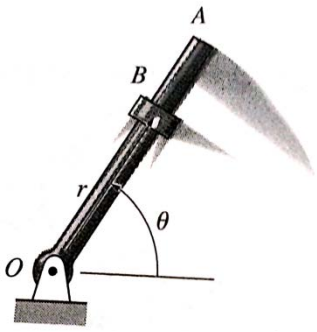



Figure 2

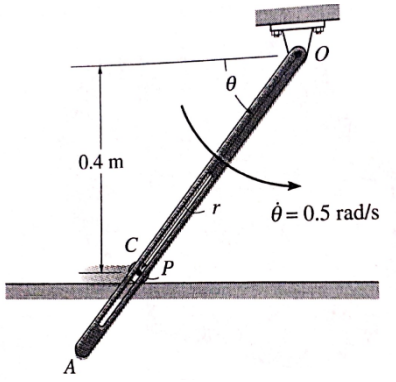



Figure 3

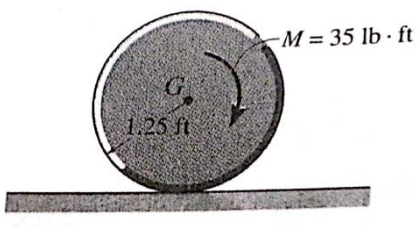



Figure 4

# 國立虎尾科技大學 102 學年度第二學期博士班資格考試題

所別：機械與機電工程研究所　　第 1 頁　共 2 頁

科目：動力學

注意事項：

（1）本試題共有 5 題，每題 20 分，合計一百分。Closed book

（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。

（3）可使用計算機

1. Determine the magnitude of force F as a function of time, which must be applied to the end of the cord at A to raise the hook H with a constant velocity of v = 0.4 m/s. Initially the chain is at rest on the ground. Neglect the mass of the cord and the hook. The chain has a mass of 2 kg/m.

2. The collar has a mass of 20 kg and is supported on the smooth rod. The attached springs are undeformed when d = 0.5 m. Determine the speed of the collar after the applied force F = 100 N causes it to be displaced so that d = 0.3 m. When d = 05 m the collar is at rest.

3. The wheel shown in Fig.3 weights 40 lb and has a radius of gyration $k_G$ = 0.6 ft about its mass center G. If it is subjected to a clockwise couple moment of 15 lb✎ft and rolls from rest without slipping, determine its angular velocity with **work and energy principle** after its center G moves 0.5 ft. The spring has a stiffness k = 10 lb/ft and is initially unstretched when the couple moment is applied.

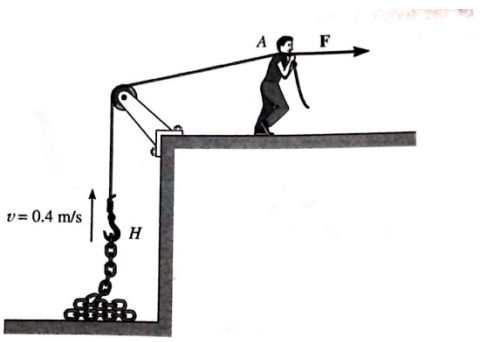



Figure 1

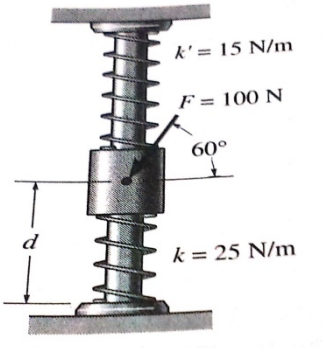



Figure 2

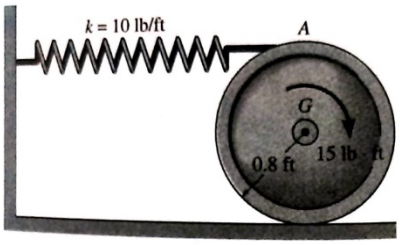



Figure 3

# 國立虎尾科技大學 102 學年度第二學期博士班資格考試題

所別：機械與機電工程研究所　　

科目：動力學

注意事項：
（1）本試題共有 5 題，每題 20 分，合計一百分。Closed book
（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
（3）可使用計算機

4. The crankshaft AB of an engine turns with a clockwise angular acceleration of 20 rad/s$^2$, Fig.4. Determine the acceleration of the piston at the instant AB is in the position shown. At this instant $\omega_{AB}$ = 10 rad/s and $\omega_{BC}$ = 2.43 rad/s.

5. Disk A, shown in Fig. 5, starts from rest and rotates with a constant angular acceleration of $\alpha_A$ = 2 rad/s$^2$. If no slipping occurs between the disks, determine the angular velocity and angular acceleration of disk B just after A turns 10 revolutions.

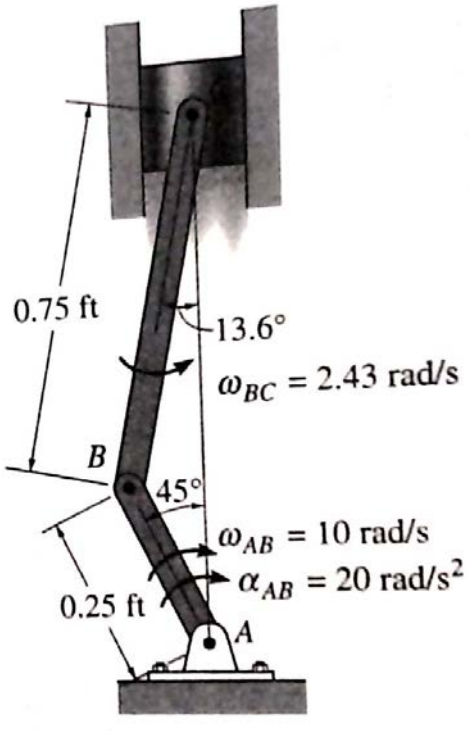



Figure 4

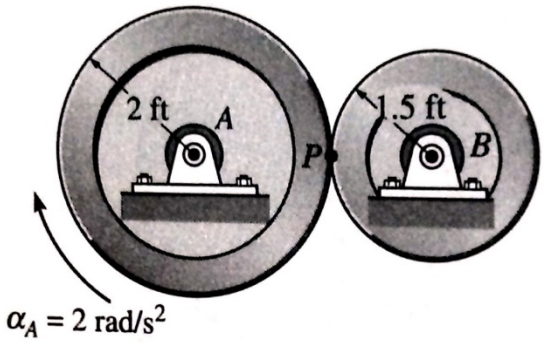



Figure 5

# 國立虎尾科技大學 103 學年度第二學期博士班資格考試題

所別：動力機械系機械與機電工程博士班本試題
科目：動力學

注意事項：
（1）本試題共有 4 題，每題 25 分，合計一百分。
（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
（3）可使用計算機，本試題為 close book 考試

1. The acceleration of a particle traveling along a straight line is $a = 0.02e^t$, where $t$ is in seconds. If $v = 0, s = 0$ when $t = 0$, determine the velocity and acceleration of the particle at $s = 4$ m. (Hint: Solving the position equation by trial and error)

2. As shown in Fig. 1, if the cam rotates clockwise with a constant angular velocity of $\dot{\theta} = 5$ rad/sec, determine the magnitudes of the velocity and acceleration of the follower rod AB at the instant $\theta = 30°$. The surface of the cam has a shape defined by $r = (200 + 100\cos\theta)$ mm.

3. As shown in Fig. 2, rotation of the robotic arm occurs due to linear movement of the hydraulic cylinders A and B. If this motion causes the gear at D to rotate clockwise at 5 rad/sec, determine the magnitude of velocity and acceleration of the part C held by the grips of the arm.

4. As shown in Fig. 3, piston P moves upward with a velocity of 7.5 m/s at the instant shown. Determine the angular velocity of the crankshaft AB at this instant.

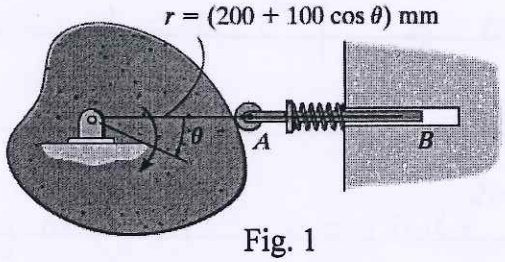



Fig. 1

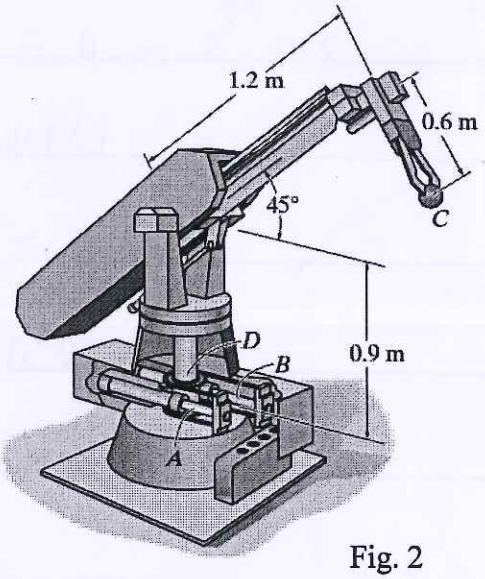



Fig. 2

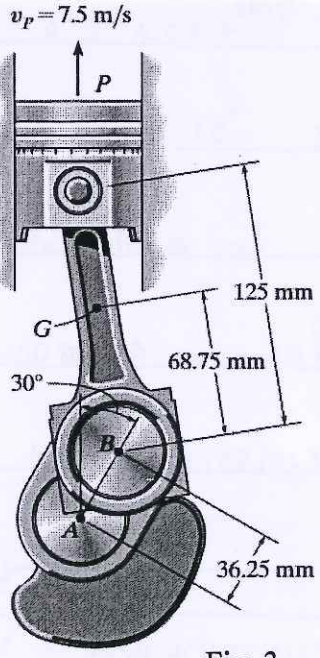



Fig. 3

# 國立虎尾科技大學 104 學年度第 1 學期博士班資格考試題

系別：動力機械系機械與機電工程博士班　　第 1 頁　共 1 頁

科目：動力學

注意事項：
（1）本試題共有 4 題，合計一百分。
（2）請依序作答於答案卷上並註明題號。
（3）可使用計算機　close book

1. A bicycle moves along a straight road such that its position is described by the graph shown in Fig. 1. Construct the $v$–$t$ and $a$–$t$ graphs for $0 \le t \le 30$ s.

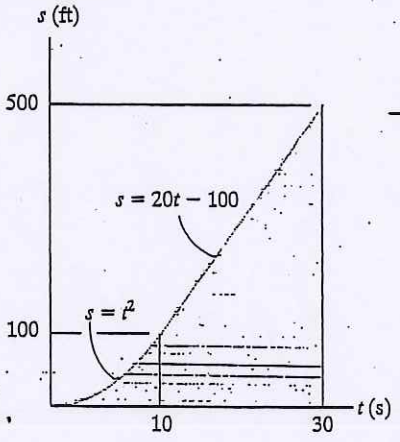
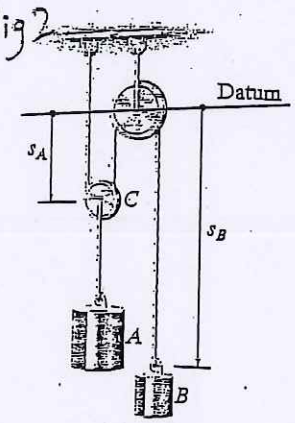



Fig 1.

20%

Fig 2




2. The 100-kg block $A$ shown in Fig. 2 is released from rest. If the masses of the pulleys and the cord are neglected, determine the velocity of the 20-kg block $B$ in 2 s. ($g = 10\ m/s^2$) (25%)

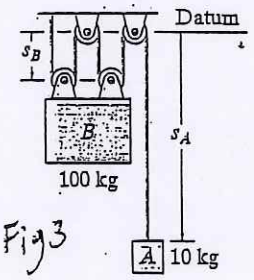
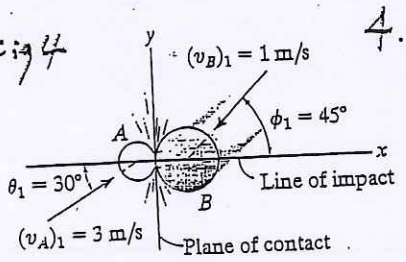



Fig 3

3. Blocks $A$ and $B$ shown in Fig. 3 have a mass of 10 kg and 100 kg, respectively. Determine the distance $B$ travels when it is released from rest to the point where its speed becomes 2 m/s. ($g = 10\ m/s^2$) (25%)

Fig 4




4. Two smooth disks $A$ and $B$, having a mass of 1 kg and 2 kg, respectively, collide with the velocities shown in Fig. 4. If the coefficient of restitution for the disks is $e = 0.7$, determine the $x$ and $y$ components of the final velocity of each disk just after collision. (35%)

# 國立虎尾科技大學 104 學年度第 2 學期博士班資格考試題

系別：動力機械系機械與機電工程博士班　　第 1 頁　共 1 頁

科目：動力學

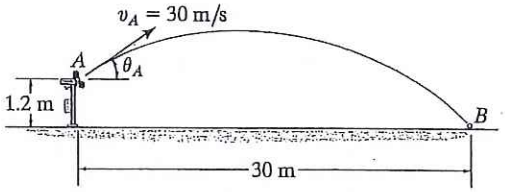
注意事項：

(1) 本試題共有 4 題，每題 25 分，合計一百分。

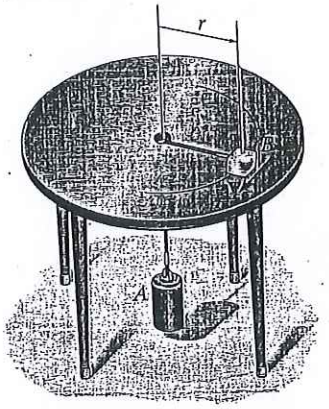
(2) 請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。

(3) 使用計算機， close book。　$g = 10.0\ m/s^2$

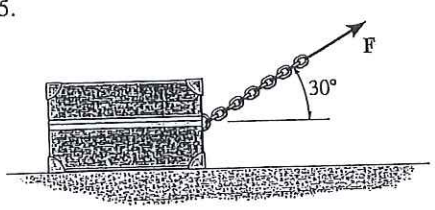
1. The pitching machine is adjusted so that the baseball is launched with a speed of $v_A = 30\,m/s$. If the ball strikes the ground at $B$, determine the two possible angles $\theta_A$ at which it was launched.



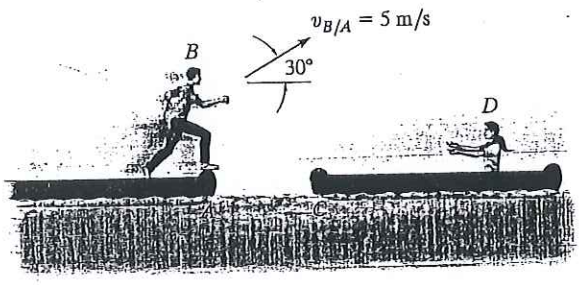

2. The 2-kg block $B$ and 15-kg cylinder $A$ are connected to a light cord that passes through a hole in the center of the smooth table. If the block travels along a circular path of radius $r = 1.5\,m$, determine the speed of the block.




3. The 20-kg crate is subjected to a force having a constant direction and a magnitude $F = 100$ N. When $s = 15$ m, the crate is moving to the right with a speed of 8 m/s. Determine its speed when $s = 25$ m. The coefficient of kinetic friction between the crate and the ground is $\mu_k = 0.25$.




4. The boy $B$ jumps off the canoe at $A$ with a velocity of 5 m/s relative to the canoe as shown. If he lands in the second canoe $C$, determine the final speed of both canoes after the motion. Each canoe has a mass of 40 kg. The boy's mass is 30 kg, and the girl $D$ has a mass of 25 kg. Both canoes are originally at rest.



# 國立虎尾科技大學105學年度第1學期博士班資格考試題

系別:動力機械系機械與機電工程博士班

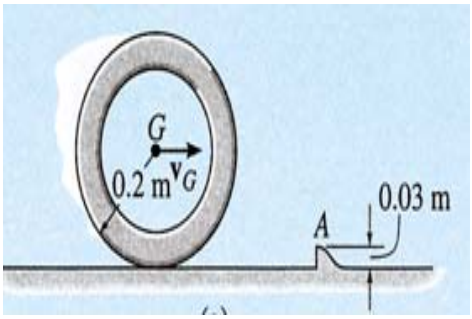
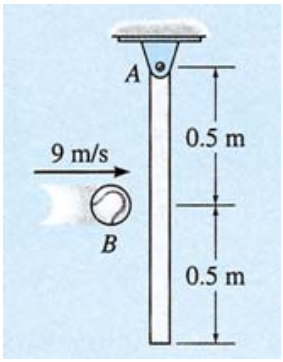
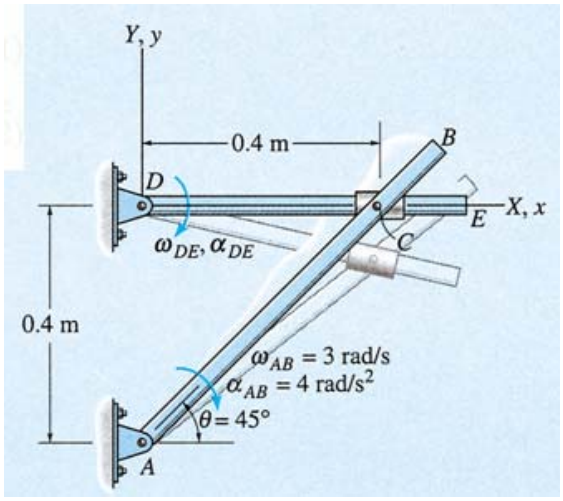
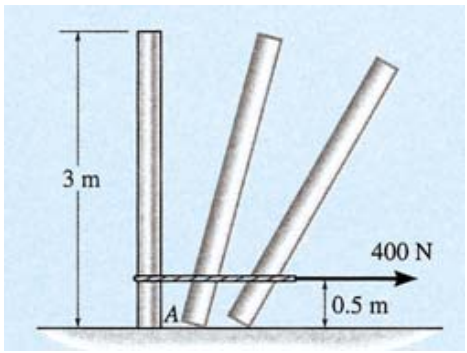
科目:動力學資格考

注意事項:

(1)本試題共有4題，合計100分。

(2)請依序作答於答案卷上並註明題號。

(3)可使用計算機 close book

| | | |
|---|---|---|
| 1 |  | The 10-Kg wheel shown in Figure has a moment of inertia $I_G$ = 0.156 Kg.m$^2$. Assuming that the wheel does not slip or rebound, determine the minimum velocity $v_G$ it must have to just rool over the obstruction at A. |
| 2 |  | The 5-kg slender rod is suspended from the pin at *A* shown in Figure. If a 1-kg ball B is thrown at the rod and strikes its center with a horizontal velocity of 9 m/s, detremine the angular velocity of the rod just after impact. The coefficient of restitution is *e* = 0.4. |
| 3 |  | The rod ***AB***, shown in Figure, rotates clockwise such that it has an angular velocity $\alpha_{AB}$ = 4 rad/s$^2$ when $\theta$ = 45$^0$. Determine the angular motion of rod DE at this instant. The collar at C is pin-connected to AB and slides over rod DE. |
| 4 |  | The uniform slender pole shown in Figure has a mass of 100 kg and a moment of inertia $I_G$ = 75 Kg.m$^2$. If the coefficients of static and kinetic friction between the end of the pole and the surface are $\mu_s$=0.3 and $\mu_k$ =0.25, respectively, determine the pole's angular acceleration at the instant the 400-N horizontal force is applied. The pole is originally at rest. |

# 國立虎尾科技大學 106 學年度第一學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班　　第 1 頁　共 1 頁

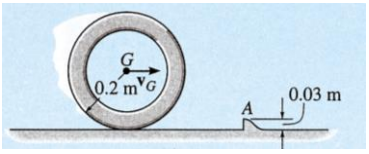
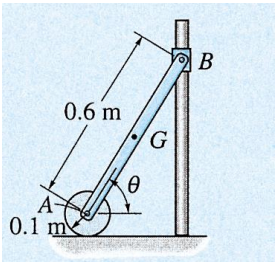
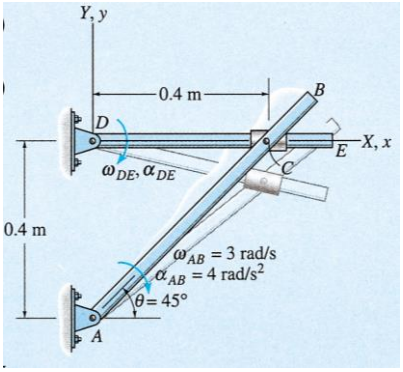
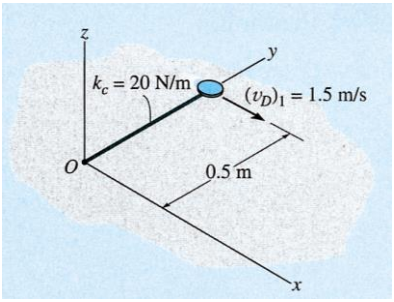
科目：動力學

注意事項：

（1）本試題共有 4 題，任選 4 題作答，每題 25 分，合計一百分。

（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。

（3）可 使用計算機， close book

| | | |
|---|---|---|
| **1** | **The 10-Kg wheel shown in Figure has a moment of inertia $I_G$=0.156 Kg.m$^2$. Assuming that the wheel does not slip or rebound, determine the minimum velocity $v_G$ it must have to has roll over the obstruction at A.** |  |
| **2** | **The 10-Kg homogeneous disk shown in Figure is attached to be a uniform 5-Kg rod *AB*. If the assembly is released from rest when $\theta$ = 60$^0$, determine the angular velocity of the rod when $\theta$ = 0$^0$. Assume that the disk rolls without slipping. Neglect friction along the guide and the mass of the collar at B.** |  |
| **3.** | **The rod *AB*, shown in Figure, rotates clockwise such that it has an angular velocity $\omega_{AB}$ = 3 rad/s and angular acceleration $\alpha_{AB}$ = 4 rad/s$^2$ when $\theta$ = 45$^0$. Determine the angular motion of rod *DE* at this instant. The collar at C is pin-connected to *AB* and slides over rod *DE*.** |  |
| **4** | **The 2=Kg disk shown in Figure rests on a smooth horizontal surface and is attached to an elastic cord that has a stiffness $k_c$ = 20 N/m and is initially unstretched. If the disk is given a velocity $(v_D)_1$ = 1.5 m/s, perpendicular to the cord, determine the rate at which the cord is being stretched and the speed of the disk at the instant the cord is stretched 0.2 m.** |  |

# 國立虎尾科技大學 107 學年度第一學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班　　第 1 頁　共 1 頁

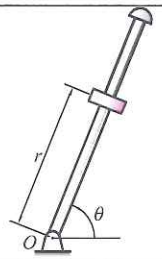
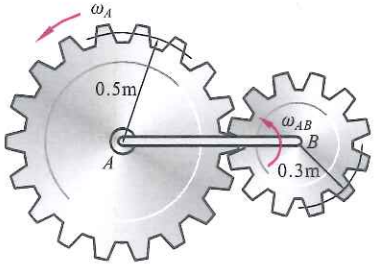
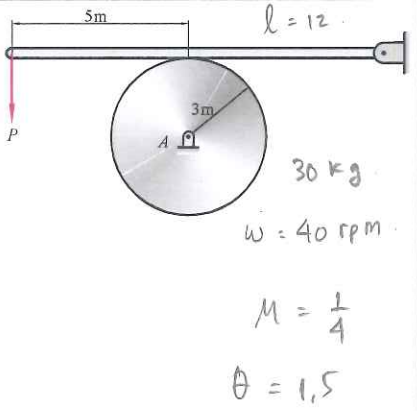
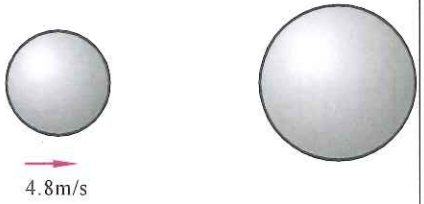
科目：動力學（**Dynamics**）

注意事項：

（1）本試題共有 4 題，任選 4 題作答，每題 25 分，合計一百分。

（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。

（3）可以使用計算機(Engineering calculator is allowable)，Close book

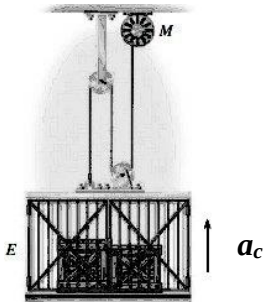
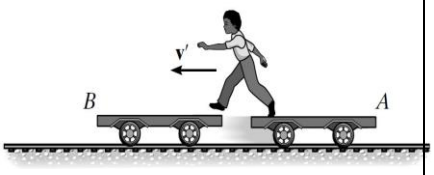
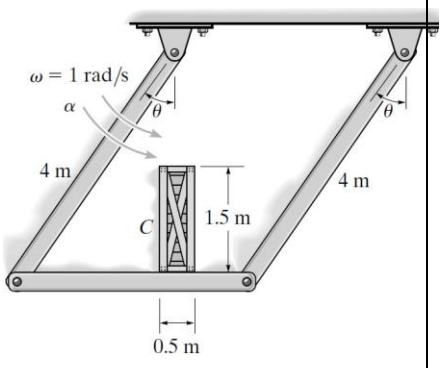
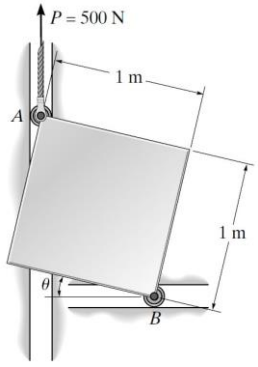
| | | |
|---|---|---|
| 1 | **The rod rotates counterclockwise around the O point, and a slider on the rod slides outward at the same time. If $r = t^2 + 6t$, $\theta = t^2$, the unit of $r$ is m, the unit of $\theta$ is rad, and the unit of $t$ is sec. Try to find the slider's velocity $v$ and acceleration $a$ at $t$=4 sec.** |  |
| 2 | **There are two gears A and B. If A is fixed, and the B gear is rolled on the A gear. When the gear A rotates at an angular speed of 7 rad/s with $r_A$=0.5m, the link AB rotates at an angular speed of 5 rad/s. Please determine the angular velocity of the gear B with $r_B$=0.3m.** |  |
| 3. | **The figure shows a wheel A with a mass of 30 kg and a rotation speed of 40 rpm. If the length of a brake lever is 12 m, the mass of a brake lever is ignored, and a pressure of P is applied to the end point to stop the wheel. Assume that the friction coefficient of the contact point between the wheel and the lever is 0.25. The wheel is stopped after the wheel rotates for 1.5 cycles. Determine the force P should be applied?** |  |
| 4 | **A steel ball $A$ with a mass of 0.8 kg move forward with a speed of 4.8 m/s to collide with another static steel ball $B$ with a mass of 2.4 kg. If the recovery elastic coefficient $e = 0.8$ between the two steel balls, please determine (a) The speed of $A$ and $B$ balls after the collision? (b) Loss of kinetic energy after collision?** |  |

# 國立虎尾科技大學 110 學年度第 2 學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班　　

科目：動力學（Dynamics）

注意事項：
（1）本試題共有 4 題，任選 4 題作答，每題 25 分，合計 100 分。
（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
（3）可使用計算機(Engineering calculator is allowable)，Close book examination。

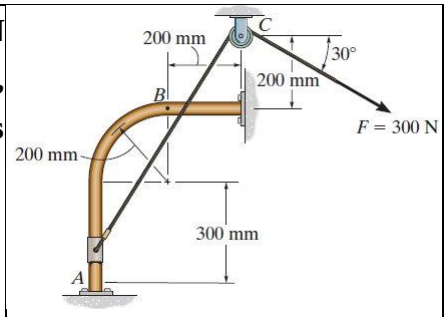
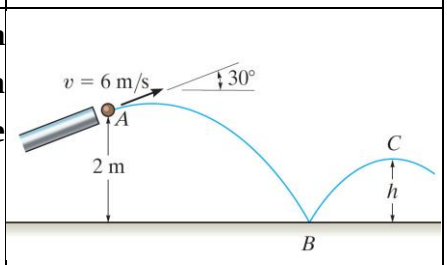
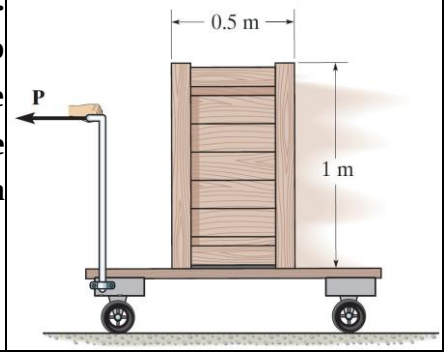
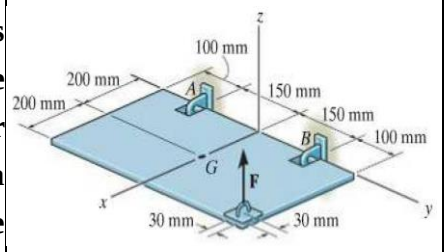
| | | |
|---|---|---|
| **1.** | **The 500-kg elevator starts from rest and travels upward with a constant acceleration $a_c = 2$ m/s$^2$. Determine the tension force of the cable and the power output of the motor $M$ when $t = 3$ s. Neglect the mass of the pulleys and cable.** |  |
| **2.** | **The 75-kg boy leaps off cart $A$ with a horizontal velocity of $v' = 3$ m/s measured relative to the cart. Determine the velocity of cart $A$ just after the jump. If he then lands on cart $B$ with the same velocity that he left cart $A$, determine the velocity of cart $B$ just after he lands on it. Carts $A$ and $B$ have the same mass of 50 kg and are originally at rest.** |  |
| **3.** | **The 50-kg uniform crate rests on the platform for which the coefficient of static friction is $\mu_s = 0.5$. If at the instant $\theta = 30°$ the supporting links have an angular velocity $\omega = 1$ rad/s and angular acceleration $\alpha = 0.5$ rad/s$^2$, determine the normal acceleration, the tangential acceleration and the frictional force on the crate.** |  |
| **4.** | **If corner $A$ of the 60-kg plate is subjected to a vertical force of $P = 500$ N, and the plate is released from rest when $\theta = 0°$, determine the angular velocity of the plate when $\theta = 45°$.** |  |

# 國立虎尾科技大學 111 學年度第 1 學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班 

科目：動力學（Dynamics）

注意事項：
（1）本試題共有 4 題，任選 4 題作答，每題 25 分，合計 100 分。
（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
（3）可使用計算機(Engineering calculator is allowable)，Close book examination。

| | | |
|---|---|---|
| **1.** | **If the cord is subjected to a constant force of F= 300 N and the 15-kg smooth collar starts from rest at A, determine the velocity of the collar when it reaches point B. Neglect the size of the pulley.** |  |
| **2.** | **The 0.5-kg ball is fired from the tube at *A* with a velocity of *v* = 6 m/s. If the coefficient of restitution between the ball and the surface is *e* = 0.8, determine the height *h* after it bounces off the surface.** |  |
| **3.** | **The 150-kg uniform crate rests on the 10-kg cart. Determine the maximum force P that can be applied to the handle without causing the crate to slip or tip on the cart. The coefficient of static friction between the crate and cart is $\mu_s$ = 0.2. Assuming that there is no friction between the wheels and ground.** |  |
| **4.** | **The uniform hatch door, having a mass of 15 kg and a mass center at *G*, is supported in the Horizontal plane by bearings at *A* and *B*. If a vertical force F = 300 N is applied to the door as shown. Please determine the components of reaction at the bearings and the angular acceleration of the door. The bearing at *A* will resist a component of force in the *y* direction, whereas the bearing at *B* will not. For the calculation, assume the door to be a thin plate and neglect the size of each bearing. The door is originally at rest.** |  |

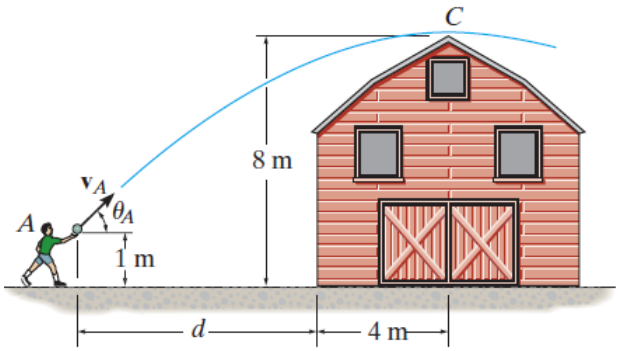
# 國立虎尾科技大學 113 學年度第 2 學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班 

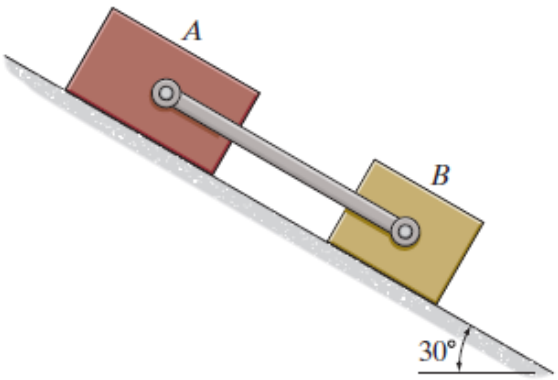
科目：動力學

注意事項：
（1）本試題共有 5 題，每 20 分，合計 100 分。
（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
（3）閉書考、可使用計算機
Close book and Engineering calculator is allowable.

1. The boy at *A* attempts to throw a ball over the roof of a barn such that it is launched at an angle $\theta_A = 40^0$. Determine the minimum speed $v_A$ at which he must throw the ball so that it reaches its maximum height at *C*. Also, find the distance *d* where the boy must stand so that he can make the throw.




2. If blocks *A* and *B* of mass 10 kg and 6 kg, respectively, are placed on the inclined plane and released, determine the force developed in the link. The coefficients of kinetic friction between the blocks and the inclined plane are $\mu_A = 0.1$ and $\mu_A = 0.3$. Neglect the mass of the link.

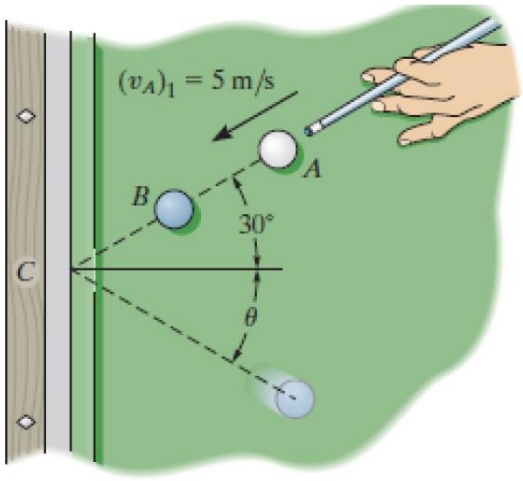


# 國立虎尾科技大學 113 學年度第 2 學期博士班資格考試題

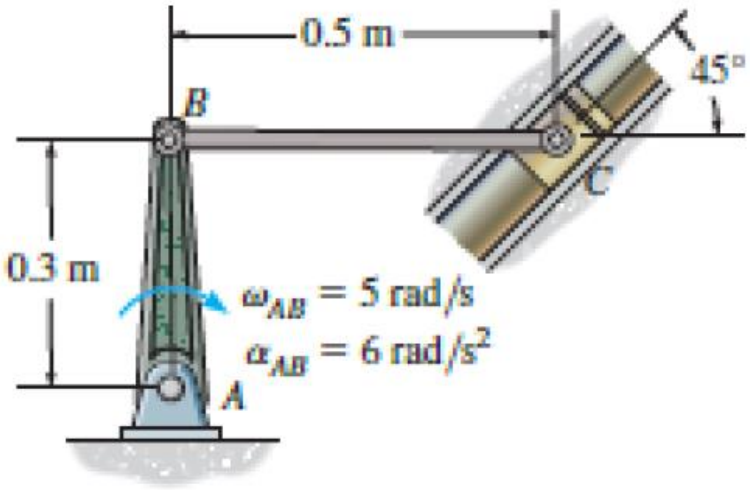
系別：動力機械工程系機械與機電工程博士班 

科目：動力學

3. The cue ball A is given an initial velocity $(v_A)_1 = 5\ (m/s)$. If it makes a direct collision with ball B (e = 0.8), determine the velocity of B and the angle θ just after it rebounds from the cushion at C ($e' = 0.6$). Each ball has a mass of 0.4 kg. Neglect their size.




4. Crank AB is rotating with an angular velocity of $\omega_{AB} = 5$ (rad/s) and an angular acceleration of $\alpha_{AB} = 6\ (\text{rad}/s^2)$. Determine the angular acceleration of BC and the acceleration of the slider block C at the instant shown.

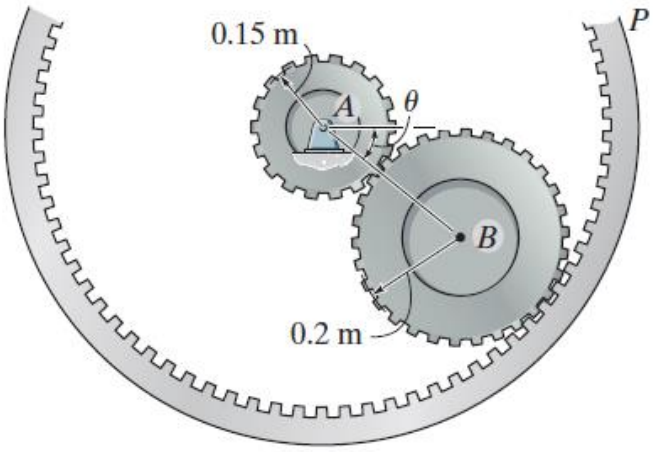


# 國立虎尾科技大學113學年度第2學期博士班資格考試題



科目：動力學

5. If the 40-kg gear B is released from rest at $\theta = 0^0$, determine the angular velocity of the 20-kg gear A at the instant $\theta = 90^0$. The radii of gyration of gear A and B about their respective centers of mass are $k_A = 125$ mm and $k_B = 175$ mm. The outer gear ring P is fixed.



# 國立虎尾科技大學 114 學年度第 1 學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班 

科目：動力學(Dynamics)

注意事項：
（1）本試題共有 4 題，任選 4 題作答，每題 25 分，合計 100 分。
（2）請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
（3）閉書考、可使用計算機
Close book and Engineering calculator is allowable.

1. **The uniform hatch door as shown in Fig. 1, having a mass of 15 kg and a mass center at *G*, is supported in the Horizontal plane by bearings at *A* and *B*. If a vertical force *F* = 300 N is applied to the door as shown. Please determine the components of reaction at the bearings and the angular acceleration of the door. The bearing at A will resist a component of force in the *y* direction, whereas the bearing at *B* will not. For the calculation, assume the door to be a thin plate and neglect the size of each bearing. The door is originally at rest.**

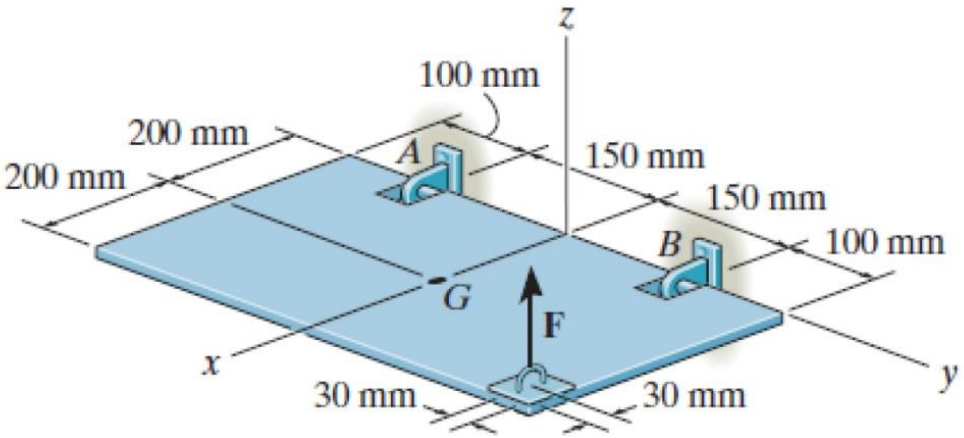



**Fig. 1**

2. **If arm *OA* is subjected to a torque of *M* = 5N-M, determine the spin angular velocity of the 10-kg disk after the arm had turned 2 revolutions, starting from the rest. The disk rolls on the horizontal plane without slipping as shown in Fig. 2. Neglect the mass of the arm.**

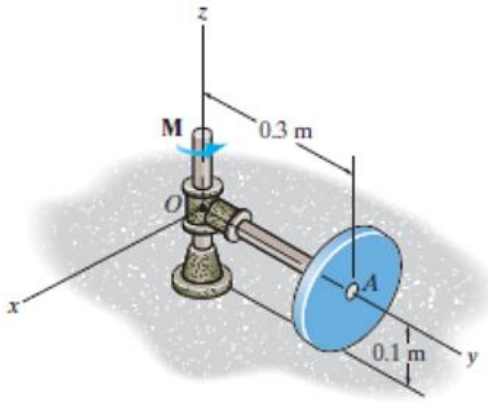



**Fig. 2**

3. **As shown in Fig. 3, a ball of mass *m* is dropped vertically from a height $h_0$ above the ground. If it rebounds to a height $h_1$, determine the coefficient of restitution between the ball and the ground.**

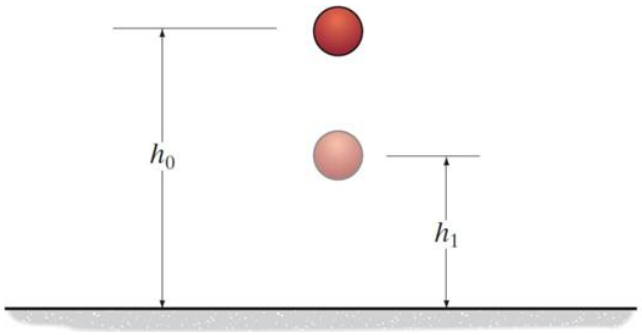



**Fig. 3**

4. **At a given instant, the slider block *A* has the velocity and acceleration as shown in Fig. 4. Determine the acceleration of block *B* and the angular acceleration of the link at this instant.**

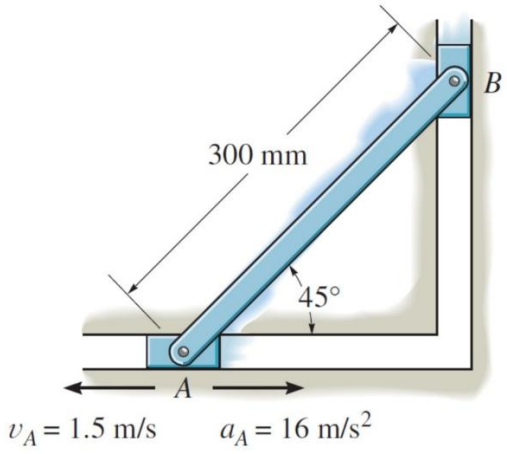



**Fig. 4**