國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：基礎熱傳學【機電系碩士班甲組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
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國立中山大學111學年度碩士班暨碩士在職專班招生考試試題

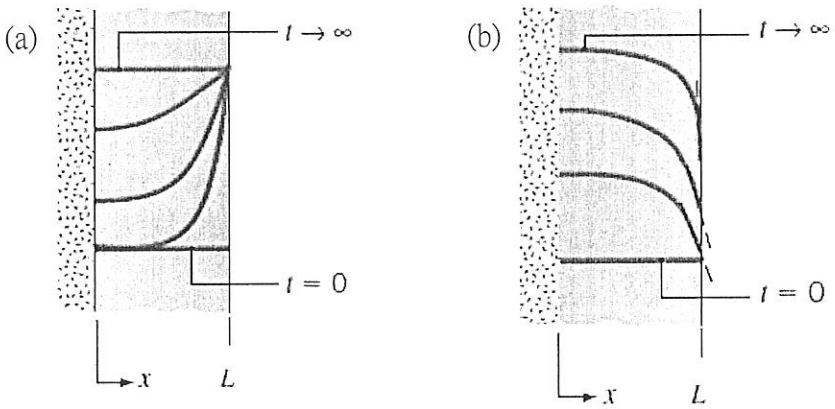
科目名稱：基礎熱傳學【機電系碩士班甲組】　　題號：438003

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1. (16%) Write the definitions of Biot number and Nusselt number. Illustrate the physical meaning.

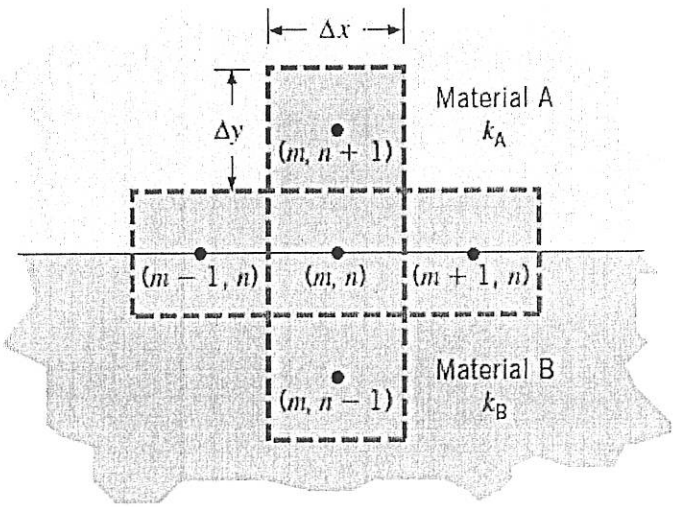
2. (10%) Write the definition of Prandtl number. What is the difference between velocity boundary layer and thermal boundary layer when Pr>1 and Pr <1.

3. (16%) Temperature distributions within a one-dimensional plane wall at an initial time, at steady state, and at several intermediate times are as shown below.



Write the appropriate form of the heat diffusion equation for each case and the equations for the initial condition and boundary conditions at $x = 0$ and $x = L$. If volumetric generation occurs, it is uniform throughout the wall. The properties are constant.

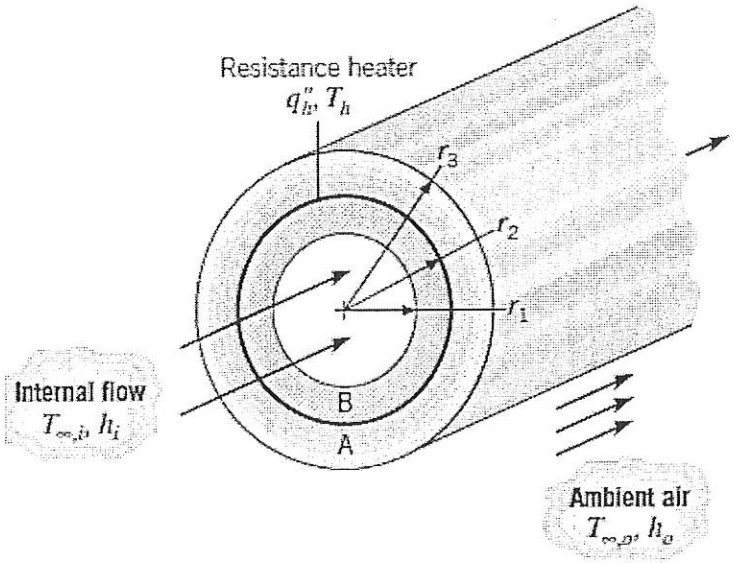
4. (15%) As shown below, the heat conduction is associated with a control volume that spans two different materials. Assume that there is no contact resistance at the interface between the materials and the control volumes are L units long into the page. Write the finite difference equation under steady-state conditions for node (m, n).



試題請隨卷繳回，請留意背面是否有題

5. (22%) For a one-dimensional heat conduction problem, the initial and boundary temperatures are $T(x,0) = f(x)$ and $T(0,t) = T(L,t) = T_\infty$. There is no volumetric heat generation or loss, and the properties are constant. Write the unsteady heat diffusion equation in dimensionless form and solve it. (Necessary reference values need to be defined for nondimensionalization.)

6. (21%) A composite cylindrical wall is composed of two materials of thermal conductivity k_A and k_B, which are separated by a very thin, electric resistance heater. The interfacial contact resistances are negligible.



Liquid pumped through the tube is at a temperature $T_{\infty,i}$ and provides a convection coefficient h_i at the inner surface of the composite. The outer surface is exposed to ambient air, which is at $T_{\infty,o}$, and provides a convection coefficient of h_o. Under steady-state conditions, a uniform heat flux of q''_h is dissipated by the heater.

(a) (7%) Sketch the equivalent thermal circuit of the system and express all resistances in terms of relevant variables.

(b) (7%) Obtain an expression that may be used to determine the heater temperature, T_h.

(c) (7%) Obtain an expression for the ratio of heat flows to the outer and inner fluids, q'_o/q'_i. How might the variables of the problem be adjusted to minimize this ratio?

國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：工程數學【機電系碩士班乙組、丙組】

—作答注意事項—

考試時間：100分鐘

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國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

科目名稱：工程數學【機電系碩士班乙組、丙組】　　題號：438001

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1. Solve the following ODEs.
   (a) $2x \tan y\, dx + \sec^2 y\, dy = 0$ (5%)
   (b) $x^3y''' + xy' - y = x^2$ (5%)

2. Given an Initial Value Problem of a system of ODEs:
   $y_1' = y_1 + 4y_2 - t^2 + 6t,\ y_1(0) = 2.$
   $y_2' = y_1 + y_2 - t^2 + t - 1,\ y_2(0) = -1.$
   The system can be represented as a vector equation $\mathbf{y}' = \mathbf{Ay} + \mathbf{g}$.
   (a) Find eigenvalues and eigenvectors of **A**. (5%)
   (b) General solution for the homogeneous part. (5%)
   (c) Particular solution for the non-homogeneous part. (5%)
   (d) Determine the stability and the type of critical point for the homogeneous part. (5%)

3. Given an ODE: $(1 - x^2)y'' - 2xy' + 2y = 0$
   (a) Find the series solution of the given ODE. (10%)
   (b) Find the arbitrary coefficients in the series solution. (5%)
   (c) Find the two solutions of the series solution respectively. (5%)

4. Using the Laplace transform and showing the details, find the current $i(t)$ in the circuit in Figure 1, assuming zero initial current and charge on the capacitor and:

   $L = 1$ H, $C = 10^{-2}$F, $v = -9900 \cos t$ V if $\pi < t < 3\pi$ and 0 otherwise. (15%)

   Note: $Li'(t) + \dfrac{q(t)}{C} = v(t)$

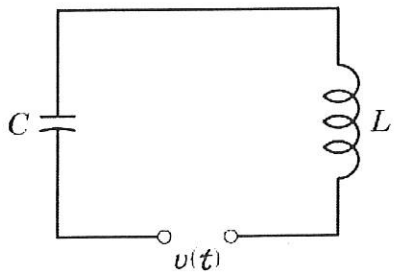

Figure 1.

5. By the principles used in modeling the string it can be shown that small free vertical vibrations of a uniform elastic beam (Figure 2.) are modeled by the fourth-order PDE (equation (1))

$$\frac{\partial^2 u}{\partial t^2} = -c^2 \frac{\partial^4 u}{\partial x^4} \qquad (1)$$

where $c^2 = EI/\rho A$ (E = Young's modulus of elasticity, I = moment of inertia of the cross section with respect to the y-axis in the figure, ρ = density, A = cross-sectional area). Find solutions $u_n = F_n(x)G_n(t)$ of equation (1) corresponding to zero initial velocity and satisfying the boundary conditions for simply supported beam in Figure 3. ($u(0,t) = 0, u(L,t) = 0, u_{xx}(0,t) = 0, u_{xx}(L,t) = 0$). (20%)

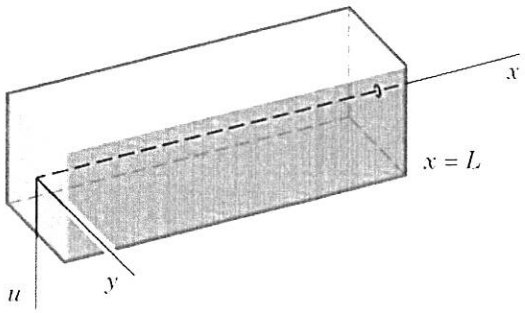

Figure 2.

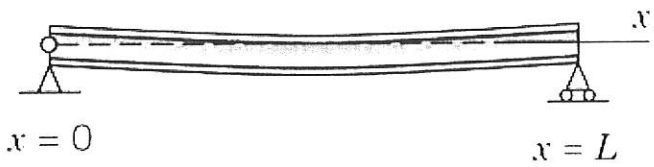

Figure 3.

6. Verify this for **A** and $\mathbf{A} = \mathbf{P}^{-1}\mathbf{AP}$. If **y** is an eigenvector of **P**, show that $\mathbf{x} = \mathbf{Py}$ are eigenvectors of A. Show the details of your work. (15%)

$$\mathbf{A} = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}, \qquad \mathbf{P} = \begin{bmatrix} 0.28 & 0.96 \\ -0.96 & 0.28 \end{bmatrix}.$$

國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：材料力學【機電系碩士班乙組】

—作答注意事項—

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國立中山大學111學年度碩士班暨碩士在職專班招生考試試題

科目名稱：材料力學【機電系碩士班乙組】 **題號：438006**

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）

Prob. #1 (20 %)

簡答題：請以中文解釋名詞或回答問題

(a) 延性材料（Ductile material）與脆性材料（Brittle material）在拉伸實驗下所具有的工程應力-應變曲線為何？請標明縱軸、橫軸所代表的參數並畫出應力-應變曲線的特徵變化 。請注意，你不需要解釋或列出這些特徵的名稱。(6 %；每錯一個扣一分，扣至 6 分為止)

(b) 在上題中，脆性材料的降伏強度（Yield strength） 是如何得到的？(2 %)

(c) 何謂等向性材料（Isotropic material）？ (2 %)

(d) 當假設桿件為軸向負荷桿件（Axially loaded bar）時，我們主要是要避免哪一種負荷的複雜影響？(2 %)

(e) 請利用公式說明何謂安全係數（Factor of safety），公式內參數的意義要說明。(2 %)

(f) 設計樑柱（Beam）時都必須畫出樑柱受到側向力所致的剪力及彎矩圖（Shear and bending moment diagrams），其原因為？ (2 %)

(g) 何謂平面應力（Plane stress）？何謂平面應變（Plane strain）？(2 %)

(h) Figure 1 所示的木頭桿件在受到轉矩（Torque）作用時產生破壞，其主要原因為何？ (2 %)

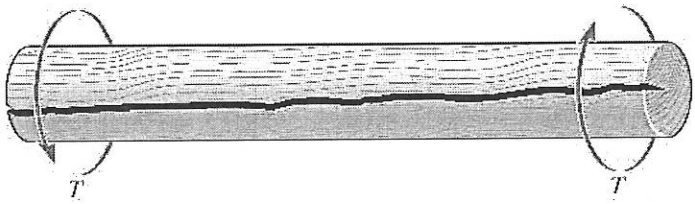

Figure 1 **Prob. #1**-(h)

Prob. #2 (30 %)

As shown in Figure 2, a shaft is made of an aluminum alloy having an allowable shear stress of τ_{allow} = 100 MPa. If the diameter of the shaft is 100 mm, determine the maximum torque **T** that can be transmitted. What would be the maximum torque **T′** if a 75-mm-diameter hole were bored through the shaft? Sketch the shear-stress distribution along a radial line in each case.

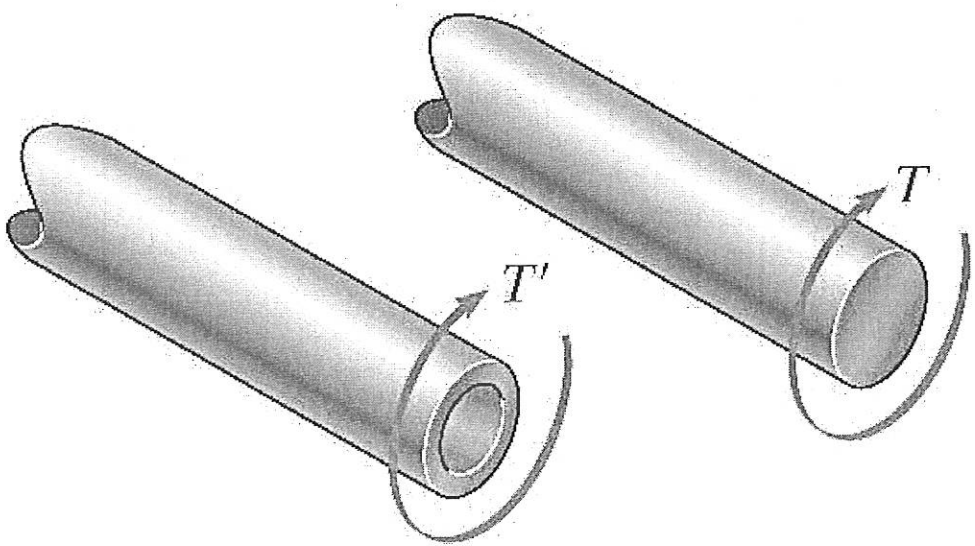

Figure 2 **Prob. #2**

Prob. #3 (30 %)

The A-36 steel rod shown in Figure 3 has a diameter of 10 mm. It is fixed to the wall at A, and before it is loaded there is a gap between the wall and the rod of 0.2 mm. Determine the reactions at A and B'. neglect the size of the collar at C. E_{st} = 200 GPa.（請注意：座標軸、Free body diagram、Equilibrium equations以及Compatibility都列入評分，請完整而清楚地作答）

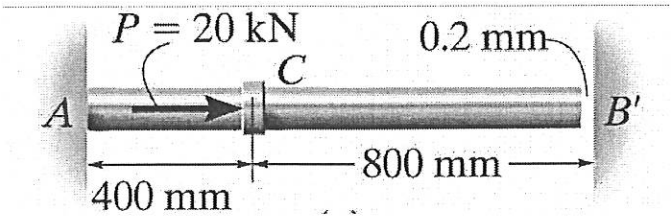

Figure 3 **Prob. #3**

Prob. #4 (20 %)

Using the equilibrium equations to determine and draw the shear and moment diagrams for the beam shown in Figure 4.（請注意：座標軸、Free body diagram、以及Equilibrium equations都列入評分，請完整而清楚地作答）

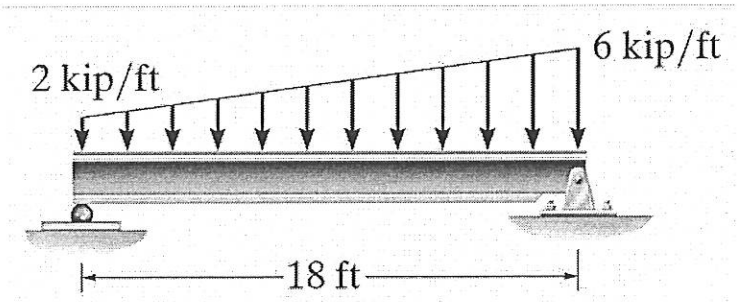

Figure 4 **Prob. #4**

國立中山大學111學年度
碩士暨碩士專班招生考試試題

科目名稱：應用力學(含靜力學及動力學)【機電系碩士班乙組】

－作答注意事項－

考試時間：100分鐘

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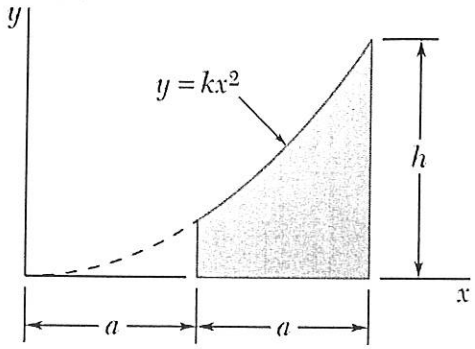
國立中山大學111學年度碩士暨碩士專班招生考試試題

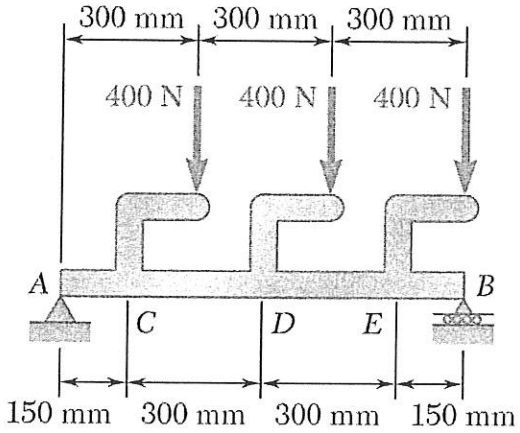
科目名稱：應用力學(含靜力學及動力學)【機電系碩士班乙組】　　題號：438008

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）(問答申論題)　　

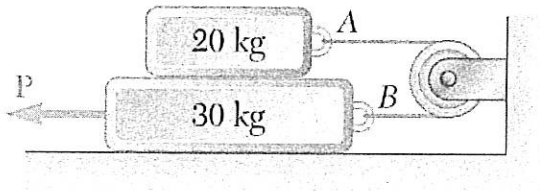
1. (**15%**) Determine by direct integration the centroid of the area shown and express **the first moment of the area** with respect to **y-axis** ($\bar{x}$) in terms of a and h.



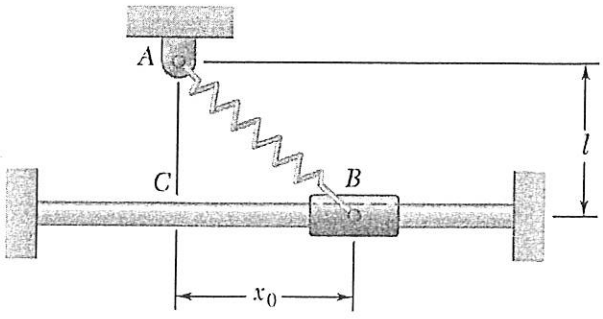
2. **(10%)** Please **draw the shear and bending-moment diagrams** for the beam ***AB***.



3. **(15%)** The **coefficients of friction are $\mu_s = 0.40$ and $\mu_k = 0.30$** between all surfaces of contact. Determine **the smallest force P** required to start the **30-kg block moving** if cable AB is attached as shown.



4. **(15%)** A spring *AB* of **constant *k*** is attached to a support at *A* and to a collar of **mass *m***. The **unstretched length of the spring is *l***. Knowing that the collar **is released** from rest at $x = x_0$ and **neglecting friction** between the collar and the horizontal rod, determine **the magnitude of the velocity of the collar** as it **passes through point *C***.

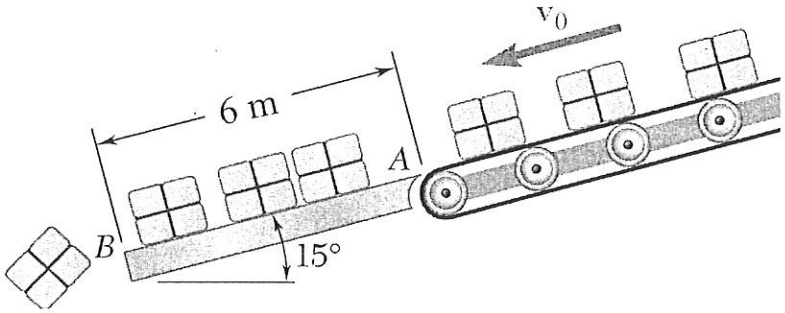


國立中山大學111學年度碩士暨碩士專班招生考試試題

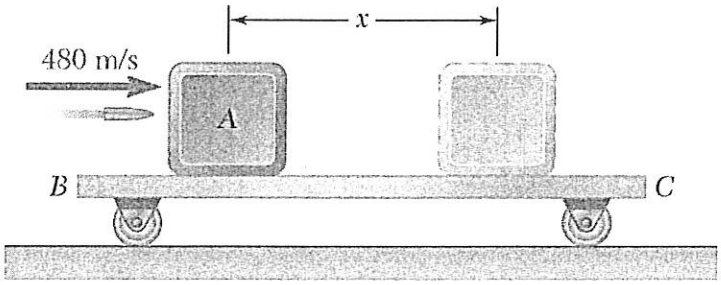
科目名稱：應用力學(含靜力學及動力學)【機電系碩士班乙組】　　題號：438008

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）(問答申論題)　　

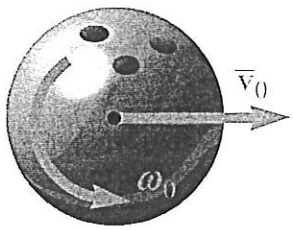
5. **(15%)** Boxes are transported by a conveyor belt with a **velocity v_0** to a fixed incline at A, where they **slide and eventually fall off** at B. Knowing that $\mu_k = 0.40$, determine **the velocity of the conveyor belt** if the boxes leave the incline at B with a **velocity of 2.5 m/s**.



6. **(15%)** A **30-g bullet** is fired with a **velocity of 480 m/s into** block A, which has a **mass of 5 kg**. The **coefficient of kinetic friction** between block A and cart BC is $\mu_k = 0.50$. Knowing that the cart has a **mass of 4 kg** and can **roll freely**, determine **the final position of the block on the cart**.



7. **(15%)** A bowler projects a **200-mm-diameter ball weighing 6 kg** along an alley with a forward **velocity v_0 of 5 m/s** and a **backspin ω_0 of 9 rad/s**. Knowing that the **coefficient of kinetic friction** between the ball and the alley is $\mu_k = 0.10$, determine **the time t_1** at which the ball will **start rolling without sliding**.



國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：自動控制【機電系碩士班丙組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答(不得另攜帶紙張)。
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- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
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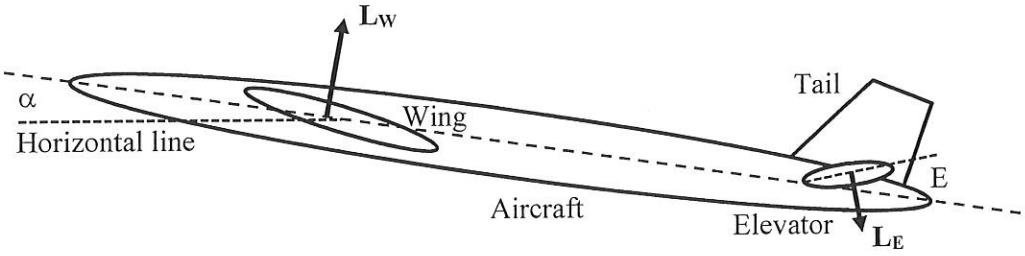
- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

國立中山大學111學年度碩士班暨碩士在職專班招生考試試題

科目名稱：自動控制【機電系碩士班丙組】　　題號：438005

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1. The vertical motion of an aircraft is determined by a lift force **Lw** applied to the wings and an aerodynamic force **LE** on the elevators (small surfaces located at the aircraft tail). The pitching of the aircraft is denoted by the angle of attack α and the elevator is measured by an angle E with respect to the body of the aircraft. Under the assumption of small angles, a linearized model of the aircraft's vertical motion can be formulated as:



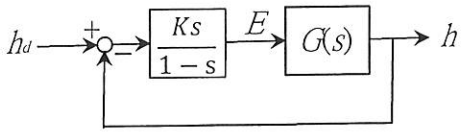
$$\ddot{h} = k_1\alpha - k_2(E - \alpha)$$

$$\ddot{\alpha} = k_3(E - \alpha) - k_4\dot{\alpha}$$

where h represents the height of the aircraft. Let $k_1 = 2$ and $k_2 = k_3 = k_4 = 1$.

(1) Derive transfer functions of the attack angle α to the angle E and the height h to the angle E. (10%)

(2) Considering a closed-loop height control system as below, where h_d is the height command and K is a positive controller gain, draw the root locus plot for the closed-loop control system with varying K. Be sure of indicating poles, zeros, asymptotes, intersection of asymptotes, locations of crossing the imaginary axis, departure angles, and their corresponding K values. (20%)



2. A transfer function is expressed by $\frac{Y(s)}{R(s)} = \frac{s-1}{(s+2)^2}$, where $R(s)$ and $Y(s)$ stand for the input and the output, respectively. Output response is denoted by $y(t) = \mathcal{L}^{-1}\{Y(s)\}$, where $\mathcal{L}$ represents the Laplace transform.

(1) Solve $y(\infty)$ and $\dot{y}(0)$ if the input is a unit step function. (10%)

(2) When a unit ramp is applied as the input, determine $\dot{y}(0)$ and the steady state error when time approaches to infinity, where the error is defined as the input minus the output. (10%)

3. 以下四個子題為簡答題，簡明扼要將問題的重點回答出來即可！

   A. (5%) In your opinion, from a control system point of view, what is the most important difference between a linear system and a non-linear system?

   B. (5%) Instead of using PID (proportional-integral-derivative) controllers, many industrial control applications prefer PI controllers. Why?

   C. (5%) Generally speaking, what is the relationship between the bandwidth and the speed-of-response of a system?

   D. (5%) Can a real physical system have an odd number of complex conjugate poles? Why or why not?

4. (15%) This problem considers a linear time-invariant system whose transfer function is $G(s) = Y(s)/X(s)$ where $X(s)$ and $Y(s)$ are the Laplace transforms of the input and output signals, respectively. With ω denoting the radian frequency, by setting $s = j\omega$, the output signal of this system can be represented as $Y(j\omega) = G(j\omega)X(j\omega)$. It can be shown that the amplitude spectrum of the output is $|Y(j\omega)| = |G(j\omega)|\,|X(j\omega)|$ and the phase spectrum of the output is $\angle Y(j\omega) = \angle G(j\omega) + \angle X(j\omega)$. Based on these two results of amplitude and phase spectra, determine the steady-state response of $y(t)$ when $G(s) = 1/(s+1)$ and $x(t) = \cos(2\pi t)$.

5. (15%) This problem considers a second-order system with complex conjugate poles. The transfer function of this system can be represented as $G(s) = \omega_n^2/(s^2 + 2\xi\omega_n s + \omega_n^2)$. With $M_{p\omega}$ denoting the maximum value of the magnitude of $G(j\omega)$ and ω_r denoting resonant frequency of this system, how do you experimentally determine the value of $M_{p\omega}$ and ω_r? If $M_{p\omega} = 1.75$ and $\omega_r = 30$ rad/sec, determine the value of ξ and ω_n based on the information given by Figure 1.

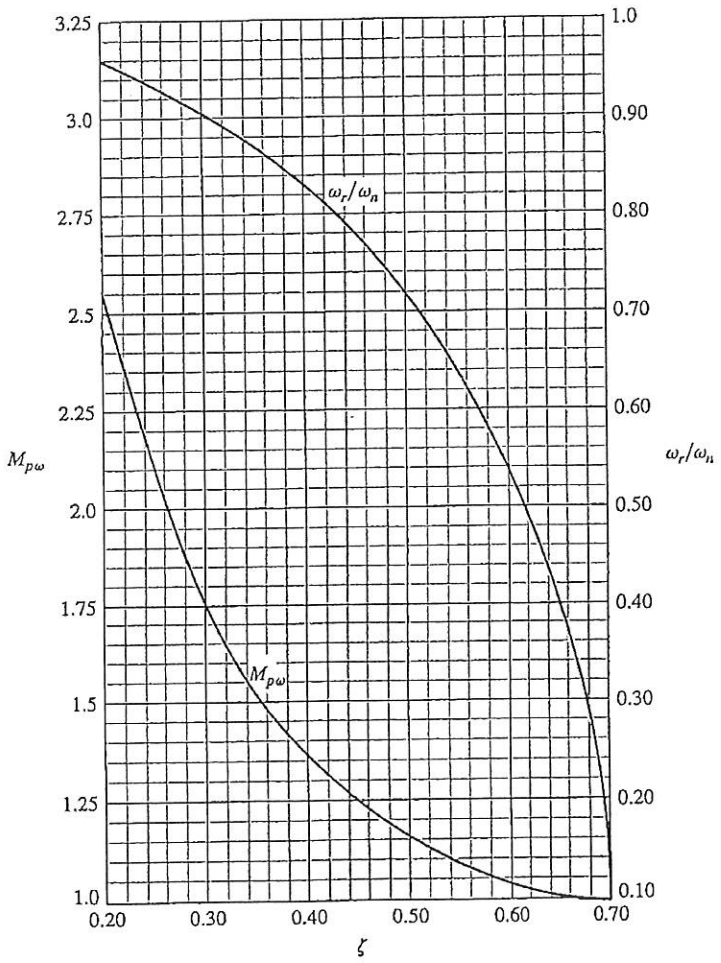


Figure 1

國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：靜力學【機電系碩士班丁組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
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- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

國立中山大學111學年度碩士班暨碩士在職專班招生考試試題

科目名稱：靜力學【機電系碩士班丁組】　　題號：438004

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1. 名詞解釋，切勿只有英文翻中文:

(a) Newton's Laws of Motion (15%)

(b) Unit Vector (5%)

(c) Moment of the couple (5%)

(d) Degree of Freedom (5%)

(e) Center of Gravity (5%)

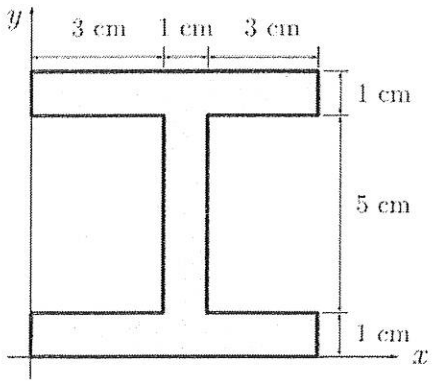
(f) Moments of Inertia (5%)

2.如圖一所示 **(Figure 1)**

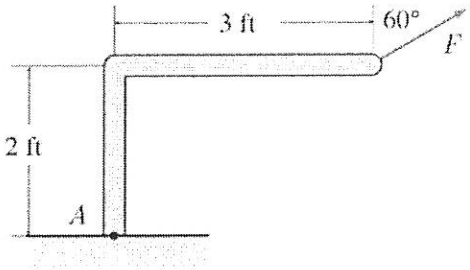
What are the coordinates of the centroid of the I beam section? (10%)

3. 如圖二所示 **(Figure 2)**

A 750 lb force, F, is applied to the frame. Determine the moment this force makes about point A (20%)



圖一 **(Figure 1)**



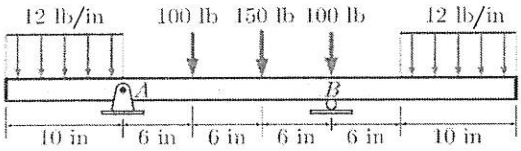
圖二 **(Figure 2)**

4. 如圖三所示 **(Figure 3)**

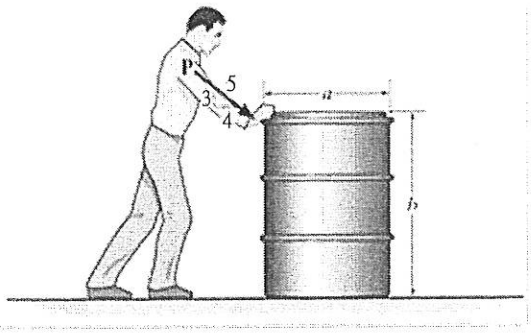
Find the reaction at the support B for the beam. (15%)

5. 如圖四所示 **(Figure 4)**

The drum on the floor has a weight of 100 lb and the coefficient of static friction is μs=0.5. If a=3 ft and b=4ft, determine the smallest magnitude of the force P that cause the impending motion of the drum. (15%)



圖三 **(Figure 3)**



圖四 **(Figure 4)**

國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：動力學【機電系碩士班丁組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答(不得另攜帶紙張)。
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- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
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- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

科目名稱：動力學【機電系碩士班丁組】　　題號：438007

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　共 2 頁第 1 頁

1. The acceleration of a particle is defined by the relation $a = kt^2$. (a) Knowing that $v = -8$ m/s when $t = 0$ s and that $v = +8$ m/s when $t = 2$ s, determine the **constant** k. (b) Write the **equations of motion** [i.e., $x(t)$], knowing also that $x = 0$ when $t = 2$ s. (20%)

2. As shown in Figure 1, the crane shown rotates at the constant rate $\omega_1 = 0.5$ rad/s; simultaneously, the telescoping boom is being lowered at the constant rate $\omega_2 = 0.20$ rad/s. Knowing that at the instant shown the length of the boom is 6 m and is increasing at the constant rate $u = 0.5$ m/s. Determine the **velocity** and **acceleration** of Point B. (20%)

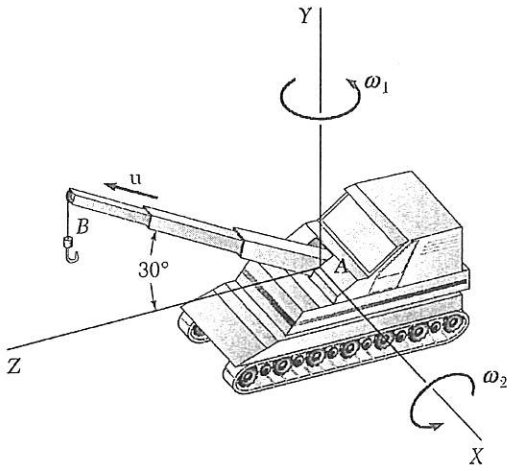

Figure 1.

3. As shown in Figure 2, each of the gears A and B has a mass of 12 kg and has a radius of gyration of 250 mm; gear C has a mass of 3 kg and has a radius of gyration of 100 mm. If a couple **M** of constant magnitude 10 N-m applied to gear C, determine (a) the **angular acceleration** of gear A, (b) the **tangential force** which gear C exerts on gear A. (20%)

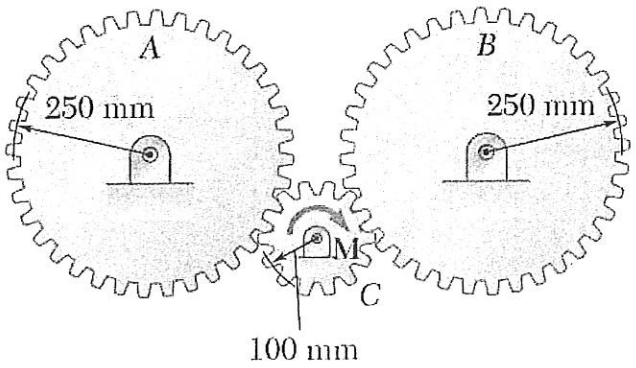

Figure 2.

4. As shown in Figure 3, the catcher arm has a mass of 10 kg and is 2.4 m long (you can model it as a slender rod); the net that catches the drone at B has a negligible mass. The 1.5 kg drone has a mass moment of inertia about its own center of mass of 0.015 kg·m^2. Knowing that the arm swings to an angle of 45° below horizontal, determine (a) the **initial velocity** v_o of the drone, (b) the **forces** at A at that angle. (20%)

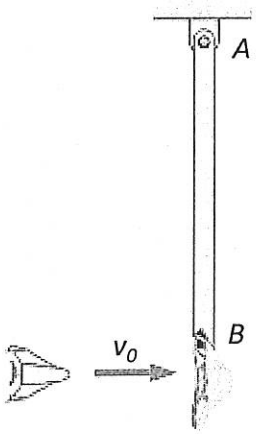

Figure 3.

5. As shown in Figure 4, the uniform 100-kg beam AB is hanging initially at rest with $\theta = 0$ when the constant force $P = 300$ N is applied to the cable. Determine (a) the **maximum angular velocity** reached by the beam with the corresponding angle θ and (b) the **maximum angle** θ_{max} reached by the beam. (20%)

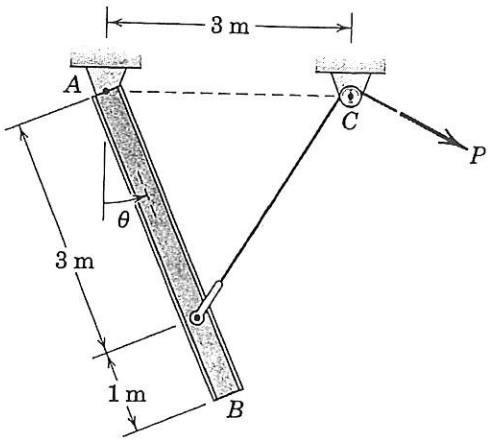

Figure 4.

國立中山大學111學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：科技英文【機電系碩士班戊組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答(不得另攜帶紙張)。
- 答案卡請以2B鉛筆劃記，不可使用修正液（帶）塗改，未使用2B鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

科目名稱：科技英文【機電系碩士班戊組】　　題號：438002

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

1. Please read the following article and answer the question below:

Soft robots are just that: soft. They're created from malleable, changeable materials like silicone elastomers and hydraulic fluidics that have a greater range of motion than traditional robotic devices. This side of robotics draws inspiration from nature—a line of study called biomemetics. Soft robots can move as some animals, for instance scurrying sidewise or climbing up a wall.

Because soft robots offer a huge potential to the robotics community, the study of pliant, elastic robots is also experiencing rapid development.

Advancements in robotics take place every day as the field grows, matures, and develops products over a wide range of industries. Soft robots are not there yet. Their development hinges on materials that can be folded, stretched, or otherwise formed into different lengths, widths and shapes. The potential of pliant, elastic robots is great and researchers are building myriad examples that may eventually find their way into medicine, manufacturing, aeronautics and other industries.

Please translate the following terms into Chinese **(3% for each)**

malleable (A)_____	silicone elastomers (B)_____	draws inspiration (C)_____	community (D)_____	pliant (E)_____
Advancements (F)_____	matures (G)_____	hinges (H)_____	myriad examples (I)_____	eventually (J)_____

2. Translate the following two sentences into Chinese: **(10% for each)**

(A) Industrial robots are used for all sorts of dangerous, repetitive jobs. Now that robots are being combined with artificial intelligence, will they take over the rest of the factory floor?

(B) Waste biomass undergoing pyrolysis can be seen through the wiewport of this reaction vessel. Estimates suggest that as much as 1 billion tons of biomass could be available each year.

3. Read the following article and fill in the correct "vocabulary" to correctly complete the meaning of the articles. **(3% for each)**

Robotics Automation Explores New Frontiers

Many industries have been hit hard by the COVID-19 **(A)**. However, the robotics industry has provided a glimmer of hope. Supply chain disruption and labor restrictions have highlighted the need for increased **(B)** within the manufacturing and logistics sectors. For companies to not only survive the pandemic but also transition their operations to be more **(C)** and mitigate risk, robotic **(D)** provides a solution.

A recent panel at Robotics Week hosted by the Robotic Industries Association (RIA) shared an **(E)** view of how robotics can address the labor and manufacturing **(F)** caused by the pandemic.

The panel consisted of CEOs and presidents of ATI Industrial Automation, FANUC America, Harmonic Drive, KUKA Robotics, and SCHUNK. The executive panel discussed how robotic growth was driven by industries outside of the automotive sector for the first time in history. The boom in medical, agriculture, and e-commerce applications significantly **(G)** to the robotic industry in 2020.

"The **(H)** in robot orders that we're seeing, despite the pandemic, demonstrates the growing **(I)** in robotic and automation solutions," said Jeff Burnstein, president of the Association for Advancing Automation, said in a recent press release. "It's **(J)** to see the growth of robotics in new applications and reaching a wider group of users than ever before."

Pick the vocabulary below:

collection, disruption, surge, controllable, overlay, interest, robotics, promising, surface, pandemic, rigid, flexibility, optimistic, energetic, useful, remote, automation, contributed, promising, successful

(A)_____	(B)_____	(C)_____	(D)_____	(E)_____
(F)_____	(G)_____	(H)_____	(I)_____	(J)_____

4. Translate the following two sentences into English: **(10% for each)**

(A) 全球在減少溫室氣體排放以及減碳的努力程度不一，歐洲國家獲得最大的進展。

(B) 越來越多的製造商正在客製化他們的六軸機器人，因為它們具有更大的工作區間，並且可以處理複雜的製造程序。