國立中山大學108學年度
碩士暨碩士專班招生考試試題

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

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國立中山大學108學年度碩士暨碩士專班招生考試試題

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）　　

1. The polar coordinates of the collar A shown in Figure 1 as function of time are $r=1+2t^2$ m and $\theta=2t$ rad. Determine the velocity and acceleration of the collar in terms of polar coordinates at $t=1$ sec. (20%)

2. The two masses shown in Figure 2 are released from rest. Use the principle of impulse and momentum to determine the magnitude of their velocity 0.5 sec after they are released. (20%)

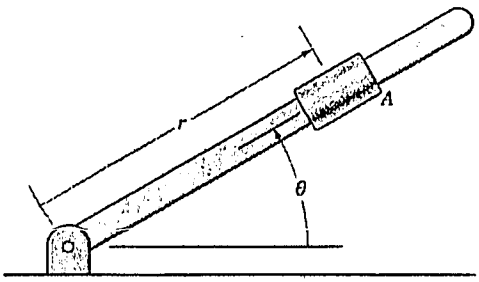

Figure 1

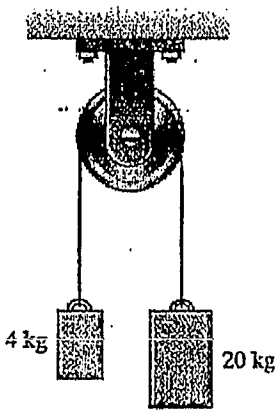

Figure 2

3. The 18-kg ladder shown in Figure 3 is released from rest in the position shown. Model it as a slender bar and neglect friction. At the instant of release, determine (a) the angular acceleration of the ladder and (b) the normal force exerted on the ladder by the floor. (20%)

4. What is the acceleration of the 8-kg collar A shown in Figure 4 relative to the smooth bar? (20%)

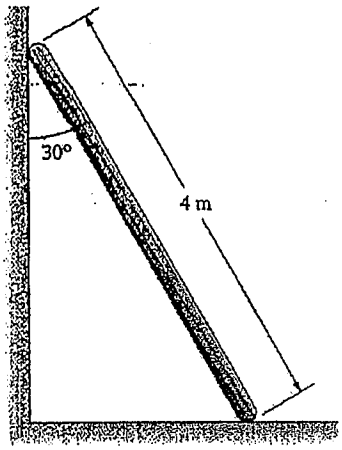

Figure 3

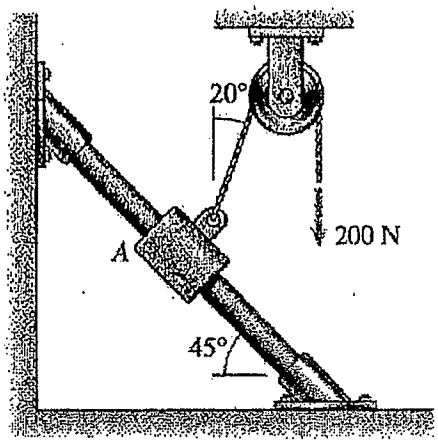

Figure 4

5. The masses of the bar and disk shown in Figure 5 are 5-kg and 10-kg, respectively. The coefficient of kinematic friction between the disk and the horizontal surface is $\mu_s=0.1$. If an 8 N-m counterclockwise couple is applied to the disk, what is its angular acceleration? (20%)

國立中山大學108學年度碩士暨碩士專班招生考試試題

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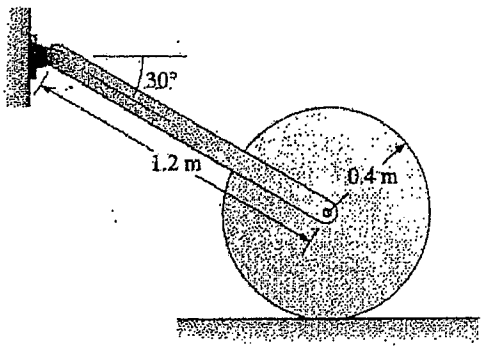

Figure 5

試題請隨卷繳回

國立中山大學108學年度
碩士暨碩士專班招生考試試題

科目名稱：材料力學【機電系碩士班乙組】

—作答注意事項—

考試時間：100分鐘

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國立中山大學108學年度碩士暨碩士專班招生考試試題

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 (30 %)

（1） Plot the engineering stress-strain diagrams for a ductile and brittle material, respectively.
（15 %，以中英文作答均可，不必依照比例，並請標出座標軸、圖上各個區域的名稱以及相對應的應力名稱，錯一個扣一分，扣至15分為止）

（2） 以中文解釋（或回答）下列名詞（或問題）(15 %)

(a) General state of stress (9 %，請畫出來並標示之，錯一個扣一分，扣至9分為止)；

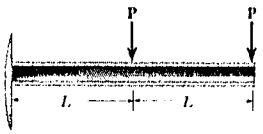
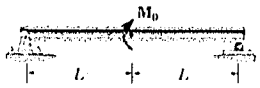
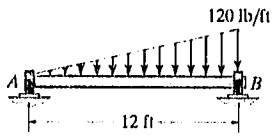
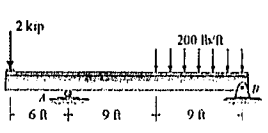
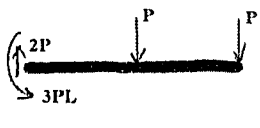
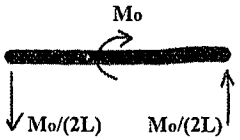
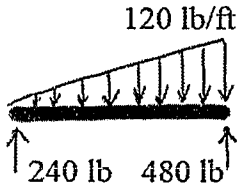
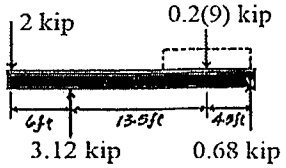
(b) Homogeneous and isotropic material (2 %)；

(c) Statically indeterminate problem (2 %)；

(d) Saint-Venant's Principle (2 %)

Prob. #2 (20 %)

Draw the shear and moment diagrams for the following beams. （請直接標示、畫出**V-及M-Diagram**，不必說明如此標示、畫圖的理由；每小題錯一個扣一分，扣至5分為止）

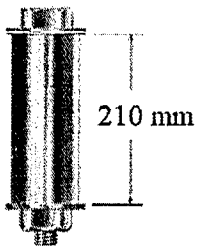
編號	(1)	(2)	(3)	(4)
Beams				
F.B.D.				

Prob. #3 (30 %)

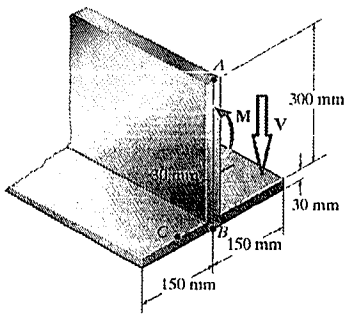
A 2014-T6 aluminum tube having a cross-sectional area of 800 mm^2 is used as a sleeve for an A-36 steel bolt having a cross-sectional area of 500 mm^2. When the temperature is $T_1 = 10^{\circ}C$, the nut holds the assembly in a snug position such that the axial force in the bolt is negligible. If the temperature increases to $T_2 = 60^{\circ}C$, determine the force in the bolt and sleeve. For A-36 steel: $E_{st} = 200$ GPa, $\alpha_{st} = 12(10^{-6})/^{\circ}C$. For 2014-T6 aluminum: $E_{Al} = 73.1$ GPa, $\alpha_{Al} = 23(10^{-6})/^{\circ}C$. （相關變形量的相對位置的示意圖必須清楚標示出來）

Prob. #4 (20 %)

If the built-up beam is subjected to an internal shear force and moment of $V = 50$ kN and $M = 100$ kN· m, determine the maximum shear, tensile and compressive stress acting in the beam.



Prob. #3



Prob. #4

試題請隨卷繳回

國立中山大學108學年度
碩士暨碩士專班招生考試試題

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

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國立中山大學108學年度碩士暨碩士專班招生考試試題

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. (10%) In Fig. 1, if $R = 8\text{k}\Omega, C = 0.025\mu\text{F}$, find $V_c(s)/V_i(s)$, percent overshoot and settling time with v_i as a step input.

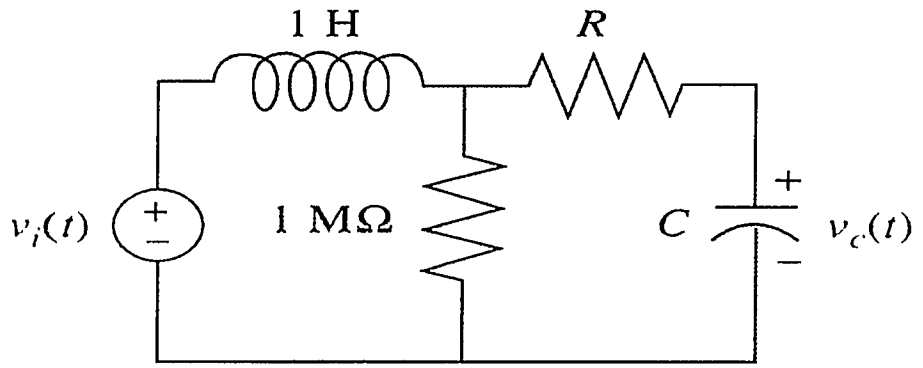

Fig. 1

2. (20%) In Fig. 2, if $G(s) = \dfrac{K(s+30)}{s(s+3)(s+7)(s+9)(s^2+20s+225)}$,

   (a) (10%) plot the root locus;

   (b) (5%) determine the range of K for stability;

   (c) (5%) briefly explain how the zeros of the open-loop system affect the root locus and the transient responses.

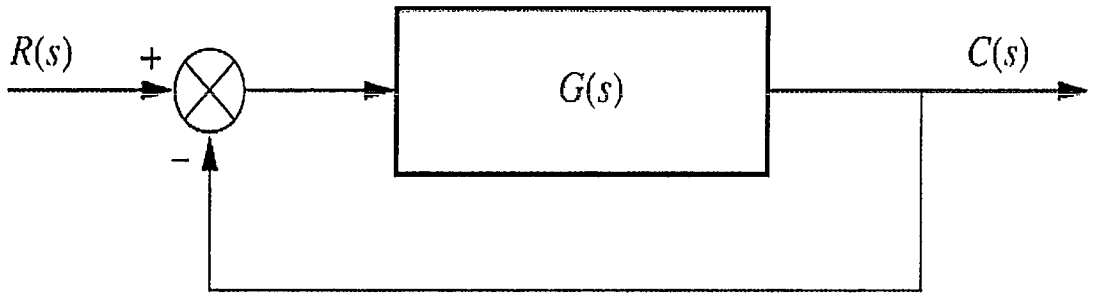

Fig. 2

3. (20%) In Fig. 2, let $G(s) = \dfrac{0.004K}{s(s+0.5)(s+40)}$. Design a lag-lead controller to meet the specifications with a 10% overshoot, a settling time of 1 second and velocity error constant $K_v = 1000$ for the closed loop system.

4. (20%) In Fig. 2, let $G(s) = \dfrac{K}{s(s+2)(s+6)}$.

   (a) (5%) Sketch the Bode plots of $G(s)$ if $K = 1$.

   (b) (15%) Try to design a PID controller to obtain zero steady-state error for a ramp input and a 50° phase margin.

試題請隨卷繳回

國立中山大學108學年度碩士暨碩士專班招生考試試題

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5. (30%) In Fig. 3, please do the following statements.

(a) (15%) Derive the transfer function $\theta_o(s)/\theta_i(s)$ and determine the range of K for stability.

(b) (5%) If the closed-loop transfer function $\theta_o(s)/\theta_i(s)$ of a unit feedback system is obtained from (a), please determine the open-loop transfer function.

(c) (10%) Sketch the Bode plots of the open-loop transfer function from (b) if $K=1$. Use the frequency response techniques to explain the stability of (a).

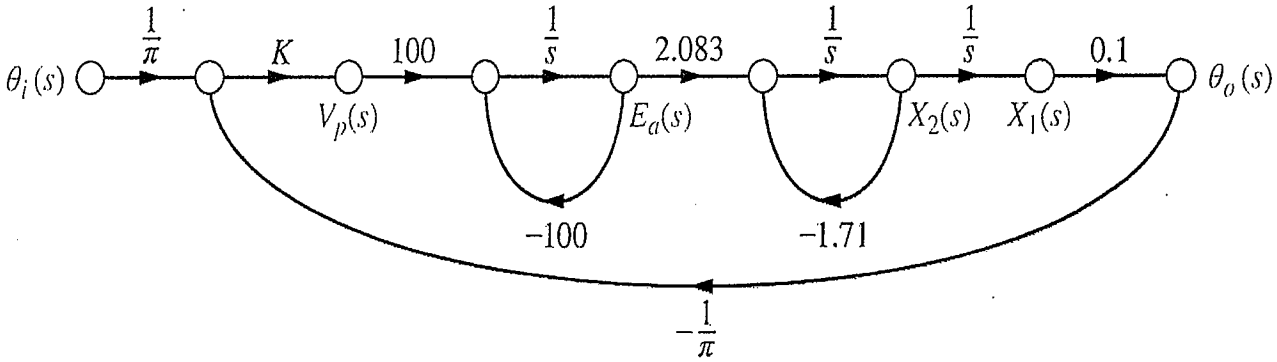

Fig. 3

國立中山大學108學年度
碩士暨碩士專班招生考試試題

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108學年度碩士暨碩士專班招生考試試題

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）　　共 1 頁第 1 頁

1. (15%) Find the current $i(t)$ in the RC-circuit in **Fig. 1** if a single rectangular wave with voltage V_0 is applied. The circuit is assumed to be quiescent before the wave is applied.

   Note. $Ri(t)+\frac{q(t)}{C}=Ri(t)+\frac{1}{C}\int_0^t i(\tau)d\tau=v(t)$

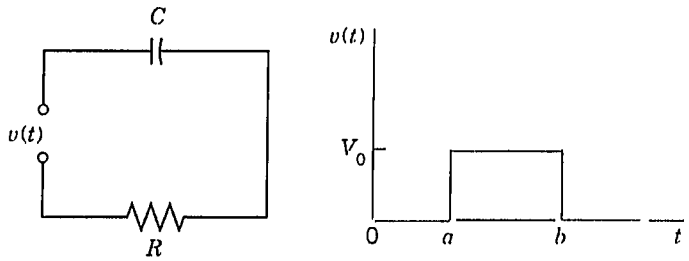

Fig. 1

2. (15%) Given an ODE $y'''-3y''+3y'-y=e^x-x-1$. Find y(x).

3. (20%) There are two tanks which tank T_1 initially contains 100 gal of pure water. Tank T_2 initially contains 100 gal of water in which 150 lb of salt are dissolved. The inflow into T_1 is 4 gal/min from T_2, and 12 gal/min containing 12 lb of salt from the outside. The inflow into T_2 is 16 gal/min from T_1. The outflow from T_2 is 4 + 12 = 16 gal/min. The mixtures are kept uniform by stirring. Find the salt contents $y_1(t)$ and $y_2(t)$ in T_1 and T_2, respectively.

4. (20%) A multiple choice question. Suppose **A** is a n x n matrix. In the following statements, which ones are true? (Deduct 2 points for one incorrect answer)

   (A) If **A** has an inverse, then the inverse is unique.
   (B) **A** and $\mathbf{A}^T$ have the same eigenvalues.
   (C) If **A** has n distinct eigenvalues, then A has a basis eigenvectors.
   (D) If **A** is symmetric, its eigenvectors are orthogonal.
   (E) If **A** is full rank, $\mathbf{Ax}=\mathbf{b}$ has a unique solution $\mathbf{x}=\mathbf{A}^{-1}\mathbf{b}$.
   (F) If **A** is full rank, then the Nullity of **A** is 0.
   (G) If **A** is full rank, the column vectors of **A** spans $\mathcal{R}^3$.
   (H) For any n x n matrix **B**, det (**A**) det (**B**)= det (**AB**).
   (I) If **A** has n independent eigenvectors, then **A** is diagonalizable.
   (J) If **A** is an orthonormal matrix, then $|\det(A)|^2=1$.

5. (15%) Find the moment of inertia

   $$I_z=\iiint_V (x^2+y^2)dxdydz$$

   of the upper half of a solid sphere $x^2+y^2+z^2=4$ about the z-axis.

6. (15%) Solve the wave equation

   $$\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}\ (0<x<l, t>0)$$

   B.C.: $u(0,t)=u(l,t)=0$
   I.C.: $u(x,0)=f(x), u_t(x,0)=g(x)$

試題請隨卷繳回

國立中山大學108學年度
碩士暨碩士專班招生考試試題

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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- 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108學年度碩士暨碩士專班招生考試試題

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(選擇題)　　

Please choose the appropriate letters a, b, c, or d. Write your answers in boxes 1~50 on your answer sheet. (單選題，一題2分，總共50題，總分100分)

1. Which of the following has no unit
   (a) kinematic viscosity
   (b) surface tension
   (c) bulk modulus
   (d) strain

2. Compared to burn due to air at 100°C, a burn due to steam at 100°C is
   (a) Less dangerous
   (b) Equally dangerous
   (c) Not dangerous
   (d) More dangerous

3. The unit of force in S.I. units is
   (a) kilogram
   (b) watt
   (c) newton
   (d) dyne

4. When a moving bus suddenly stops, a person sitting
   (a) Stands up
   (b) Falls forward
   (c) Falls backward
   (d) Is unaffected

5. Which of the following is the most common type of failure in industry?
   (a) Fatigue
   (b) Brittle fracture
   (c) Ductile fracture
   (d) Creep

6. Which of the following cannot be used as bio-materials?
   (a) Metals
   (b) Ceramics
   (c) Polymers
   (d) None of the mentioned

7. The stress corresponding to _____ of strain in the stress-strain curve of mild steel is known as proof stress.
   (a) 0.2%
   (b) 0.32%
   (c) 0.5%
   (d) 0.6%

8. Book kept on a table is an example for
   (a) First law of motion
   (b) Second law of motion
   (c) Third law of motion

(d) Inertia

9. Creep is a _____ dependent phenomenon.
   (a) Temperature
   (b) Load
   (c) Time
   (d) Stress cycle

10. The tensile test is carried on _____ materials.
   (a) brittle
   (b) malleable
   (c) ductile
   (d) plastic

11. Hooke's law holds good up to
   (a) limit of proportionality
   (b) yield point
   (c) breaking point
   (d) elastic limit

12. The unit of Young's modulus is
   (a) kg
   (b) kg/cm^2
   (c) mm/mm
   (d) kg/cm

13. A mechanical component may fail as a result of which of the following
   (a) general yielding
   (b) elastic deflection
   (c) fracture
   (d) each of the mentioned

14. Percentage reduction of area in performing tensile test on cast iron may be of the order of
   (a) 50%
   (b) 25%
   (c) 15%
   (d) 0%

15. A body is moving along a straight path. What will happen to the body in the absence of an external field?
   (a) It will stop
   (b) It will move with the same speed in a different path
   (c) It will move with a reduced speed along the same path
   (d) It will move with the same speed along the same straight path

16. The materials having same elastic properties in all directions are called
   (a) ideal materials
   (b) uniform materials
   (c) paractical materials
   (d) isotropic materials

17. A person is standing in an elevator. In which situation he finds his weightless?
(a) When the elevator moves upward with constant acceleration
(b) When the elevator moves downward with constant acceleration
(c) When the elevator moves upward with uniform velocity
(d) When the elevator moves downward, with uniform velocity

18. The unit of work or energy in S.I. units is
(a) kilogram
(b) joule
(c) newton
(d) watt

19. The transfer of heat between two bodies in direct contact is called
(a) Radiation
(b) conduction
(c) convection
(d) none of the mentioned

20. The unit of power in S.I. units is
(a) Kilogram
(b) watt
(c) Newton
(d) Dyne

21. A beam subjected to bending moment undergoes which of the following stresses?
(a) Compressive
(b) Tensile
(c) Both compressive & tensile
(d) None of the mentioned

22. In which medium sound travels faster?
(a) Liquid
(b) Solid
(c) Gas
(d) Water vapor

23. What is the unit for stress?
(a) N/m^2
(b) Nm^2
(c) N/m
(d) Nm

24. The driver of a car suddenly sees a broad wall in front of him. He should
(a) Turn sharply
(b) Keep going
(c) Brake sharply
(d) Jump out of the car

25. The transfer of heat between a wall and a fluid system in motion is called
(a) radiation
(b) conduction

(c) convection
(d) none of the mentioned

26. When we shake the branch of a tree, its fruits and dry leaves fall down. This is an example for
(a) Inertia of rest
(b) Inertia of motion
(c) Inertia of direction
(d) Newton's third law of motion

27. The bending moment on a section is maximum where shear force is
(a) changing sign
(b) kilogram
(c) maximum
(d) zero

28. Factor of safety is defined as the ratio of
(a) ultimate stress to working stress
(b) working stress to ultimate stress
(c) breaking stress to ultimate stress
(d) ultimate stress to breaking stress

29. When a bar is subjected to a change of temperature and its deformation is prevented, the stress induced in the bar is
(a) shear stress
(b) tensile stress
(c) thermal stress
(d) compressive stress

30. The buckling load for a given material depends on
(a) slenderness ratio and area of cross-section
(b) slenderness ratio and modulus of elasticity
(c) slenderness ratio, area of cross-section and modulus of elasticity
(d) Poisson's ratio and modulus of elasticity

31. Poisson's ratio is defined as the ratio of
(a) lateral stress and longitudinal stress
(b) longitudinal stress and longitudinal strain
(c) longitudinal stress and lateral stress
(d) lateral stress and lateral strain

32. Deformation per unit length in the direction of force is known as
(a) linear strain
(b) strain
(c) linear stress
(d) unit strain

33. When a bicycle is in motion, the force of friction exerted by the ground on the two wheels is such that, it acts
(a) In the backward direction on the front wheel and in the backward direction on the rear wheel

(b) In the forward direction on the front wheel and in the backward direction on the rear wheel
(c) In the backward direction on both front and the back wheel
(d) In the forward direction in both front and the back wheel

34. The ratio of creep strain to elastic strain is known as
(a) Creep factor
(b) Creep postulate
(c) Creep coefficient
(d) Creep variable

35. The breaking stress is _____ the ultimate stress.
(a) Greater than
(b) Depends on time
(c) Equal to
(d) Less than

36. Which of the following is failure of material due to cyclic stress?
(a) Brittle fracture
(b) Fatigue
(c) Ductile fracture
(d) Creep

37. Below which point does fatigue occur?
(a) Fracture point
(b) Ultimate strength
(c) Elastic limit
(d) Yield point

38. Which one is having the highest thermal conductivity?
(a) Copper
(b) Silver
(c) Glass
(d) Earth

39. A person is standing in a bus. When the bus starts moving forward suddenly
(a) The person moves forward
(b) The person moves backward
(c) The person remains stationary
(d) The person is unaffected

40. The _____ the melting point and the _____ the elastic modulus, the higher is creep strength.
(a) Higher, higher
(b) Lower, lower
(c) Lower, higher
(d) Higher, lower

41. Hardness is
(a) Surface property
(b) Resistance to abrasion

(c) Depends upon resistance to plastic deformation of the material
(d) All of the mentioned

42. What is the most fundamental property of wave?
(a) Temperature
(b) Pressure
(c) Frequency
(d) Wavelength

43. Heat flow into a system is taken to be _____, and heat flow out of the system is taken as
(a) positive, negative
(b) positive, positive
(c) negative, negative
(d) negative, positive

44. A truck and a car are moving with equal velocity. On applying brakes, both will stop after a certain distance, then
(a) Truck will cover less distance before stopping
(b) Car will cover less distance before stopping
(c) Both will cover equal distance
(d) None of the mentioned

45. Static load is defined as the load acting on the bearing when shaft is
(a) Rotating at rpm<10
(b) Rotating at rpm<5
(c) Stationary
(d) None of the listed

46. A: On a rainy day, it is difficult to drive at high speed.
B: The value of the coefficient of friction is lowered due to wetting of the surface
(a) If both A and B are true but B is not correct explanation of A
(b) If both A and B are true and B is the correct explanation of A
(c) If A is true, but B is false
(d) If both A and B are false

47. With which factor, a magnitude of creep doesn't increase?
(a) Temperature
(b) Time
(c) Grain size
(d) Stress

48. Two balls of different masses (one lighter and one heavier) are thrown vertically upward with same initial speed. Which one will rise to a greater height?
(a) The lighter one
(b) The heavier one
(c) Both the balls
(d) Neither

49. Which of the following is the property of Newton's third law?
(a) A body moving with a uniform speed in a straight line cannot change the direction of motion by itself

(b) It is applicable only to a point particle
(c) The action and reaction cannot cancel each other
(d) It is a local relation

50. Which one is having the lowest thermal conductivity?
(a) Furnace
(b) Wool
(c) Glass wool
(d) Saw dust

國立中山大學108學年度
碩士暨碩士專班招生考試試題

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

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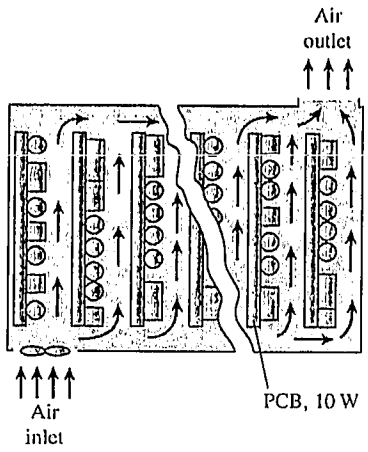
國立中山大學108學年度碩士暨碩士專班招生考試試題

科目名稱：基礎熱傳學【機電系碩士班甲組】　　題號：438003

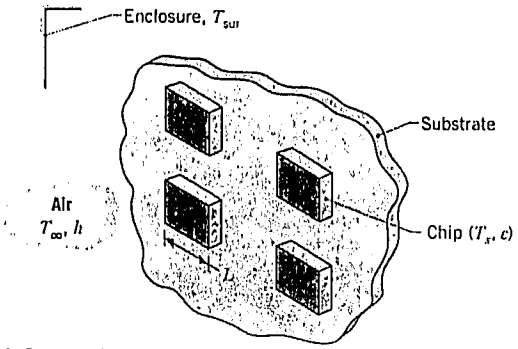
※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1.(10%) A Carnot heat pump is used to heat and maintain a residential building at 24℃. An energy analysis of the house reveals that it loses heat at a rate of 4500 kJ/h per ℃ temperature difference between the indoors and the outdoors. For an outdoor temperature of 2℃, determine (a) the coefficient of performance and (b) the required power input to the heat pump.

2.(15%) A computer cooled by a fan contains eight PCBs, each dissipating 10 W power. The height of the PCBs is 12 cm and the height is 18 cm. The cooling air is supplied by a 25-W fan mounted at the inlet. If the temperature rise of air as it flows through the case of the computer is not to exceed 10℃, determined (a)(10%) the flow rate of the air that the fan needs to deliver and (b)(5%) the fraction of the temperature rise of air that is due to the heat generated by the fan and its motor. (note: air c_p = 1.005 kJ/kg·℃ at room temperature)



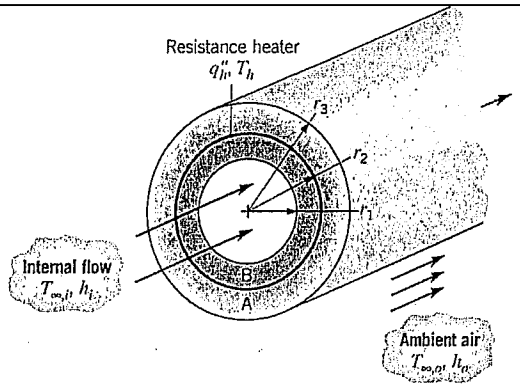
3. (15%) Chips of width L = 15 mm on a side are mounted to a substrate that is installed in an enclosure whose walls and air are maintained at a temperature of T_{air} = 25 ℃. The chips have an emissivity of ε = 0.60 and a maximum allowable temperature of T_s = 85 ℃. (note: Boltzmann constant σ = 5.67 *10^{-8} W/m^2·K^4)



(a) (10%) If heat is rejected from the chips by radiation and natural convection, what is the maximum operating power of each chip? The convection coefficient depends on the chip-to-air temperature difference and may be approximated as h = $C(T_s - T_\infty)^{1/4}$, where C = 4.2 W/m^2·$K^{3/4}$.

(b) (5%) If a fan is used to maintain airflow through the enclosure and heat transfer is by forced convection, with h = 250 W/m^2·K, what is the maximum operating power?

4. (20%) 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 for which 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.

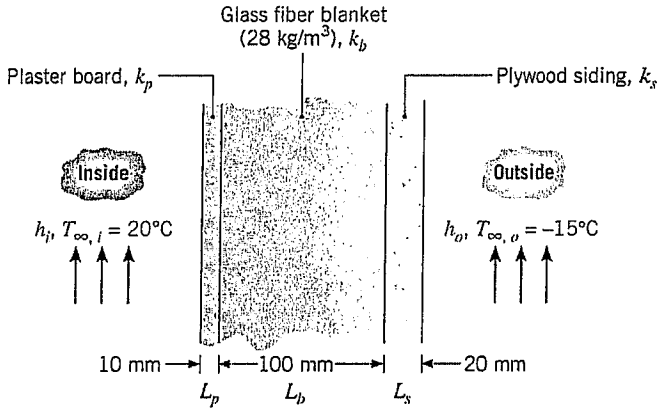


(a) (6%) Sketch the equivalent thermal circuit of the system and express all resistances in terms of relevant variables.

(b) (6%) Obtain an expression that may be used to determine the heater temperature, T_h.

(c) (8%) 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?

5. (20%) A house has a composite wall of wood, fiberglass insulation, and plaster board, as indicated in the sketch. On a cold winter day, the convection heat transfer coefficients are $h_o = 60$ W/m^2·K and $h_i = 30$ W/m^2·K. The total wall surface area is 350 m^2. (note: $k_p = 0.17$ W/m·K, $k_b = 0.038$ W/m·K, $k_s = 0.12$ W/m·K,)



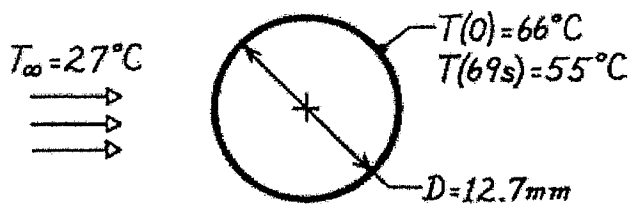
(a) (5%) Determine a symbolic expression for the total thermal resistance of the wall, including inside and outside convection effects for the prescribed conditions.

(b) (9%) Determine the total rate of heat loss through the wall.

(c) (3%) If the wind were blowing violently, raising ho to 300 W/m^2·K, determine the percentage increase in the rate of heat loss.

(d) (3%)What is the controlling resistance that determines the amount of heat flow through the wall?

6.(20%) The heat transfer coefficient for air flowing over a sphere is to be determined by observing the temperature-time history of a sphere fabricated from pure copper. The sphere, which is 12.7 mm in diameter, is at 66 ℃ before it is inserted into an airstream having a temperature of 27 ℃. A thermocouple on the outer surface of the sphere indicates 55 ℃ 69 s after the sphere is inserted into the airstream. Assume and then justify that the sphere behaves as a spacewise isothermal object and calculate the heat transfer coefficient. (note: pure copper at 60℃, $\rho = 8933$ kg/m^3, $c_p = 389$ J/kg·K, $k = 398$ W/m·K)



國立中山大學108學年度
碩士暨碩士專班招生考試試題

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

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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。
- **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108學年度碩士暨碩士專班招生考試試題

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）　　共 2 頁第 1 頁

1. 如圖一所示 (Figure 1)

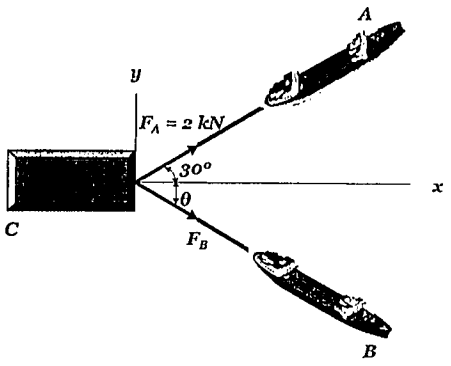
   (a) Determine the force F_B and its direction θ. If resultant force F_R of the two tugboats is 3 kN, directed along the positive x axis. (10%)

   (b) Determine the magnitude of the F_R of the two tugboats and its direction measured clockwise from the positive x axis. If $F_B = 3$ kN, and $\theta = 45°$. (10%)

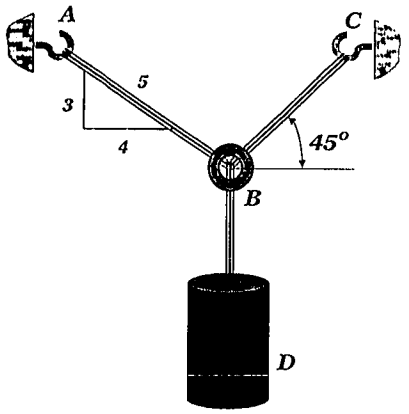
   (c) Determine the magnitude of resultant force F_R and F_B and θ. If F_R of the two tugboats is required to be directed towards the positive x axis, and the magnitude of F_B is to be a minimum. (10%)

2. 如圖二所示 (Figure 2)

   In Figure 2, the forces in cables BA and BC can be determined by investigating the equilibrium of ring B. Determine the tension in cables BA and BC necessary to support the 60-kg cylinder. (10%)



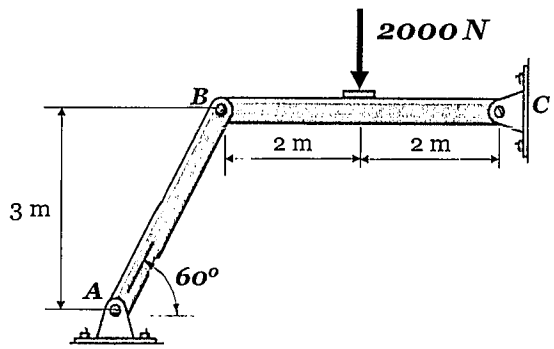
圖一 (Figure 1)



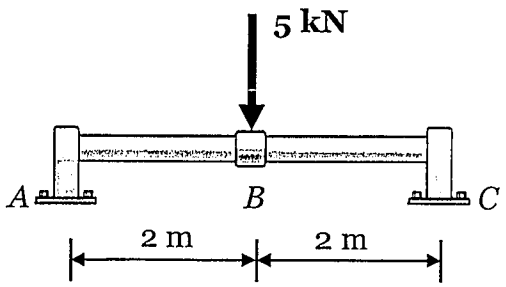
圖二 (Figure 2)

3. 如圖三所示 (Figure 3)，please draw the free-body diagrams, and calculate the equations of equilibrium. Determine BA and BC of force in which the pin at C exerts on member BC of the frame in Figure 3. (20%)

4. 如圖四所示 (Figure 4)，the support at A is a thrust bearing and the support at C is a journal bearing. Please draw the free-body diagram, the shear and moment diagrams for the shaft shown in Figure 4. (10%)



圖三 (Figure 3)



圖四 (Figure 4)

試題請隨卷繳回

國立中山大學108學年度碩士暨碩士專班招生考試試題

科目名稱：靜力學【機電系碩士班丁組】　　題號：438004

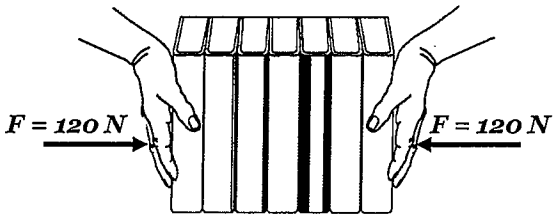
※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

5. 如圖五所示 (Figure 5)，determine the greatest number of books that can be supported in the stack. A man attempts to support a stack of books horizontally by applying a compressive force of F =120 N to the ends of the stack with his hands. If each book has a mass of 0.95 kg. The coefficient of static friction between his hands and a book is $(\mu_s)_h = 0.6$ and between any two books $(\mu_s)_b = 0.4$ (10%)

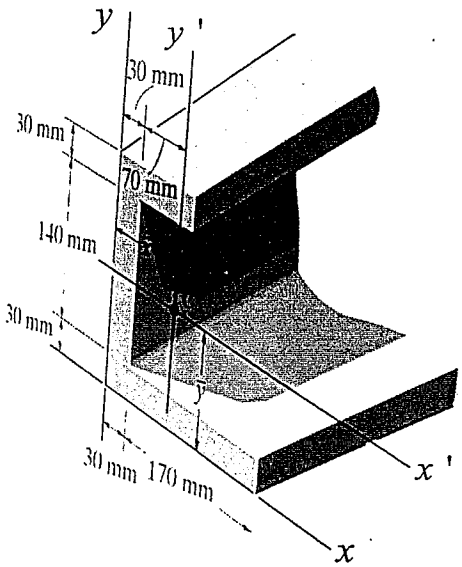
6. 如圖六所示 (Figure 6)

(a) Determine the moment of inertia of the beam's cross-sectional area about the x axis, and the y axis. (10%)

(b) Determine the distance $\bar{y}$ and $\bar{x}$ to the centroid C of the beam's cross-sectional area and then compute the moment of inertia $\bar{I}_{x'}$ about x' axis, and $\bar{I}_{y'}$ about y' axis. (10%)



圖五 (Figure 5)



圖六 (Figure 6)

國立中山大學108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

- **考試開始響前不得翻閱試題，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，不得另攜帶紙張，請衡酌作答。
- 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，其後果由考生自行負擔。
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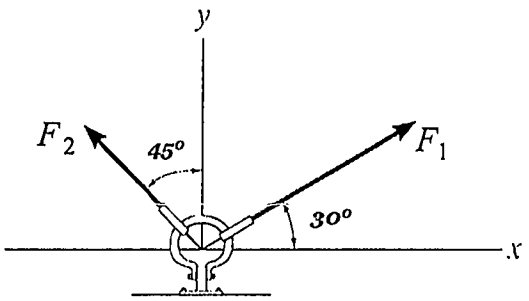
國立中山大學 108 學年度碩士暨碩士專班招生考試試題

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

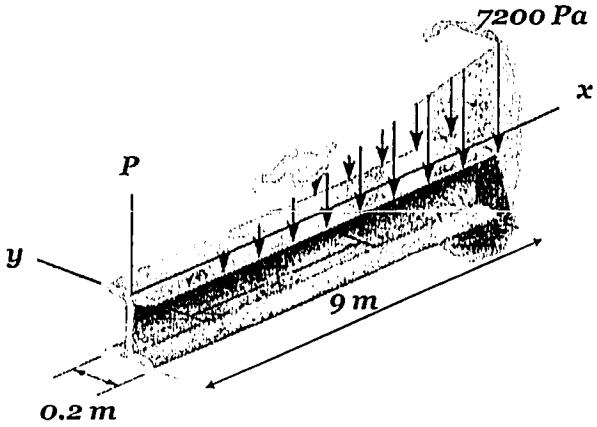
※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）(問答申論題)　　共 2 頁第 1 頁

1. 如圖一所示 **(Figure 1)**. F_1 = 600 N, and F_2 = 400 N. Determine magnitude and direction of the resultant force F_R. (10%)

2. 如圖二所示 **(Figure 2)**. Determine the magnitude and location of the equivalent resultant force F_R. A distributed load of $P = (800x)$ **Pa** acts over the top surface of the beam. (10%)



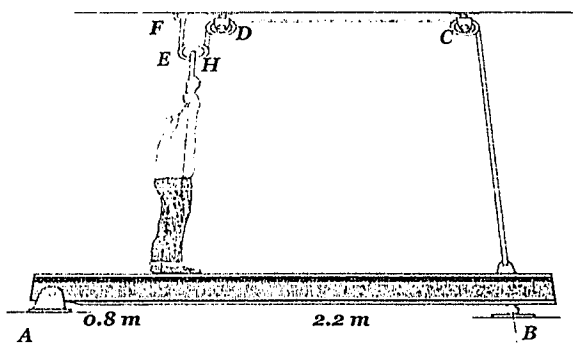
圖一 **(Figure 1)**



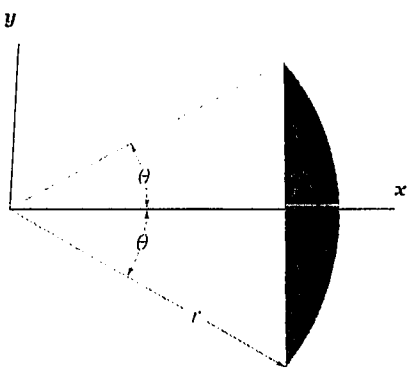
圖二 **(Figure 2)**

3. 如圖三所示 **(Figure 3)**. Please draw the free-body diagram, and calculate the equations of equilibrium. Determine the tension developed in the cable attached to *B* and the normal reaction of the man on the beam when this is about to occur. The 75-kg man attempts to lift the 40-kg uniform beam off the roller support at *B*. (20%)

4. 如圖四所示 **(Figure 4)**. Determine the moment of inertia of the shaded area about the *x* axis and *y* axis. (10%)



圖三 **(Figure 3)**



圖四 **(Figure 4)**

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國立中山大學108學年度碩士暨碩士專班招生考試試題

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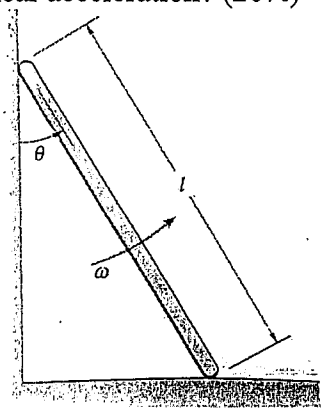
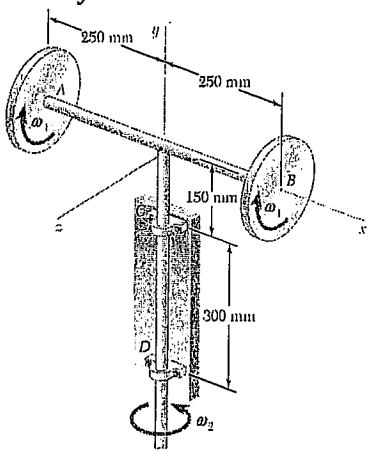
5. 如圖五所示 **(Figure 5)**. The slender bar of mass m slides on the smooth floor and wall without friction force and has counterclockwise angular velocity ω at the instant shown. What are the bar's angular acceleration and linear acceleration? (20%)



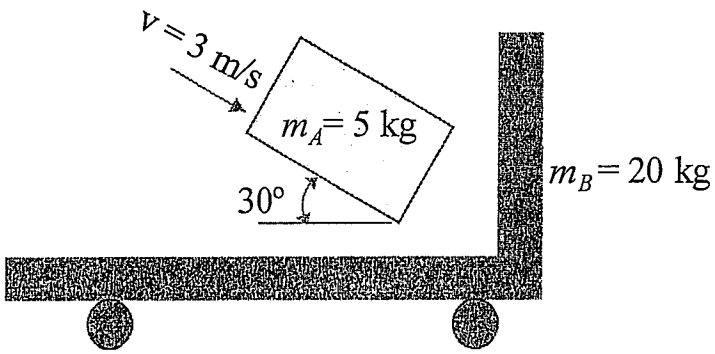
圖五 **(Figure 5)**

6. 如圖六所示 **(Figure 6)**. Two disks A and B, each of mass 6 kg and radius 200 mm, spin at $\omega 1$=1500 rpm about a rod AB of negligible mass which rotates about a vertical axis at the rate $\omega 2$ =60 rpm. Determine the dynamic reactions at C and D. (15%)



圖六 **(Figure 6)**

7. 如圖七所示 **(Figure 7)**. 包裹 5 kg 具有速度 3 m/s 且沿著 30° 落下，碰撞 20kg 的靜止台車，碰撞過程持續 0.002 秒，且碰撞後包裹與台車一起運動。求碰撞後台車的速度？包裹所受到的作用力？碰撞過程能量損失率？（考慮台車與地面的反作用力僅為垂直方向且無摩擦力）(15%)



圖七 **(Figure 7)**