

龍華科技大學
九十一學年度機械系碩士班
「機械製造」科目試題卷

1. 詳述砂模鑄造(Sand Casting) ? (10%)
2. 何謂“降伏應力”、“塑性變形”、“潛變”、“疲勞破壞”、“脆性破壞” ? (10%)
3. 塑膠的成型加工法有哪幾類 ? (10%)
4. 鐵—鐵碳相變化圖中之“肥粒鐵”、“沃斯田鐵”、“雪明碳鐵”之含碳量各為何 ? 其機械性質又各為何 ? (10%)
5. 切削方法有哪幾類 ? 並繪圖說明之 ? (10%)
6. 碳鋼依含碳量多寡可區分成那三類 ? 其含碳量、應用場合又各為何 ? (10%)
7. 詳述製造積體電路的方法 ? (10%)
8. 比較聚合物、金屬、陶瓷三種基地組織複合材料(matrix composite material)之主要機械性質 ? (10%)
9. 彈性製造系統 (FMS) 的優點為何 ? (10%)
10. 四項鑄造參數以外，鑄造時會影響熔融金屬流動性之四項主要特徵(因素)為何 ? 其影響性又各為何 ? (10%)

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「熱力學」科目試題卷

1. Electronic components of a computer are cooled by air flowing through a fan mounted at the inlet of the computer enclosure. For noise control, the velocity of the atmospheric air enters the computer enclosure cannot exceed 1.2m/sec. Air leaving the enclosure through exits at 35°C. The heat generated by all components sums up to 100W. In addition, the fan provides 20W of energy to the air. Under steady state assumption, what is the smallest inlet area should be. The atmospheric condition is at 23°C and 1 atm. The specific heat capacity for air is approximately 1 KJ/kg-K. The gas constant for air is 287 J/kg-K.
2. The base area of a cylindrical water tank is 2 m². Water flows into the tank from its top at a constant mass flow rate 10 kg/sec. Water exits through a pipe at the bottom with a mass flow rate (kg/sec) proportional to the depth of the water inside: $\dot{m} = 3\sqrt{h}$, where h is the instantaneous depth of the water, in meter. The density of water is 1000kg/m³. Find the depth of the water at equilibrium.
3. Two copper blocks, one is 2kg at 30°C the other is 5kg at 50°C, are put into a tank. The tank contains water 20 kg at 25°C initially. Neglect the heat dissipates into surrounding, what would the final temperature be when reaches equilibrium. The specific heat of copper is 0.4 kJ/kg-°C, while water is 4.2 kJ/kg-°C.
4. A thermal engine can reach to a high working temperature 800°C. If the engine is used under a 20°C surrounding temperature, what would the ideal thermal efficiency be?

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「自動控制」科目試題卷

1. (15% total) Given the following transfer function,

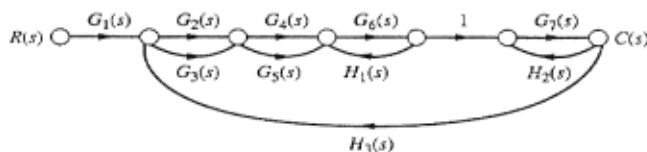
$$\frac{C(s)}{R(s)} = \frac{24}{s^3 + 9s^2 + 26s + 24}$$

- (a) (5%) Find the associated differential equation.
 (b) (10%) Find the state-space representation in phase-variable form.

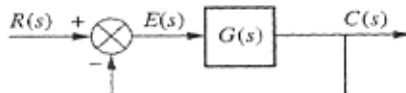
2. (10% total) For the second-order system below, find ζ , ω_n , and T_s .

$$T(s) = \frac{120}{s^2 + 12s + 120}$$

3. (15% total) Using Mason's rule, find the transfer function, $T(s) = C(s)/R(s)$, for the system represented by the following figure.



4. (60% total) Given the unity feedback system



- (a) (20%) Find the range of gain, K , to ensure stability of system with

$$G(s) = \frac{K(s+2)}{(s^2+1)(s+4)(s-1)}$$

- (b) (20%) when $G(s) = \frac{K(s^2+2s+5)}{(s+2)^2(s+3)}$

- (i) Find the system type.
 (ii) What error can be expected for an input of $10u(t)$?
 (iii) What error can be expected for an input of $10t u(t)$?

- (c) (20%) when $G(s) = \frac{K(s+3)}{s(s+1)(s+2)}$, draw the Bode diagrams including both gain and phase plots.

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「工程數學」科目試題卷

Engineering Mathematics

1. (10%) Solve the following differential equations:

$$(1) \quad (D - 2)^2 y = \frac{e^{2x}}{x^2}$$

$$(2) \quad (D - 2)^2 y = e^{2x}$$

2. (15%) By using Laplace Transform method, solve the following equation:

$$y' + 3y + 2 \int_0^t y dt = 8, y(0) = 0$$

3. (15%) Please find the Fourier Cosine Series of the function:

$$f(x) = x, \quad 0 < x < 2$$

4. (15%) $\vec{A} = x^2 \vec{i} + xy \vec{j}$

(1) Is \vec{A} rotational or irrotational?

(2) Try to find $\phi(x, y)$, if possible, such that $\nabla \phi = \vec{A}$.

5. (15%) $A = \begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$

(1) Solve the eigenvalues and eigenvectors of A.

(2) Find A^{10}

6. (20%) Evaluate $\int_0^{\infty} \frac{1}{1+x^4} dx$

7. (10%) Evaluate

$$\int_c \left[\left(x^2 y \cos x + 2xy \sin x - y^2 e^x \right) dx + \left(x^2 \sin x - 2ye^x \right) dy \right],$$

where c: $x^2 + y^2 = a^2$ (a closed contour).