93學年度國立成功大學 機械工程學系 研究所招生考試 機械工程(專業)試題 共 2 頁 第 1 頁

本科含(1)工程數學(2)熱工學(3)材料力學(4)機械設計(5)機械製造(6)自動控制，每科2題共12題，任選4題作答，每題25分，4題合計一百分。

(二)工程數學：

1. 試求解 $y'-\alpha y=\beta y^2$ ； 其中 α 與 β 為常數。(25%)

2. 試述何謂 Sturm-Liouville Problems, 並證明其任二解必具直交性(orthogonality) (25%)

(三)熱工學：

3. (a) If we raise the pressure in an isentropic process, does h (enthalpy) go up or down? Is that independent upon the phase? (b) If the efficiency of a power plant goes up as the low temperature drops why not let the heat rejection go to a refrigerator at say $-10^{\circ}C$ instead of ambient $20^{\circ}C$? (25 %)

4. Consider an air-standard Otto cycle that has a heat addition of 1800 kJ/kg of air, a compression ratio of 7, and a pressure and temperature at the beginning of the compression process of 90 kPa and $10^{\circ}C$. Assuming constant specific heats, $C_v=0.717kJ/kg\text{-}K$ and $C_p=1.004kJ/kg\text{-}K$, determine the maximum pressure and temperature of the cycle, the thermal efficiency of the cycle, and the mean effective pressure. (25 %)

(三)材料力學：

5. Please specifically propose five methods to increase the buckling strength of a column subjected to compressive load. (25 %)

6. What is von-Mises stress (or effective stress)? Please write down the mathematical expression of this quantity in terms of two-dimensional principal stresses. Explain how to use this stress quantity in mechanical design. (25%)

(四)機械設計：

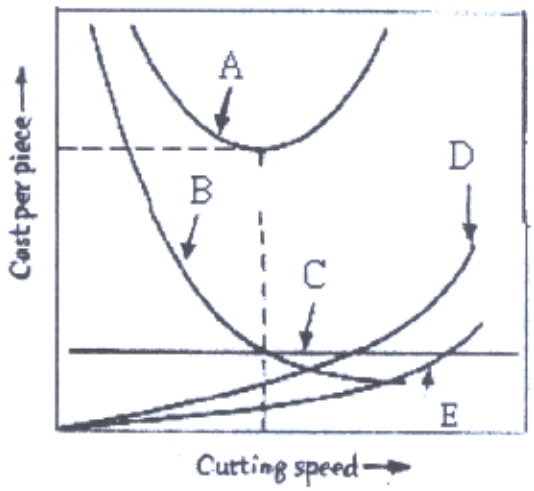
7. 請舉你實際參與的設計案例，說明面對一個新的設計案件時，設計者得瞭解那些事情，經由那些步驟，利用那些方法，解決那些問題，直到達成設計結果。 (25%)

(背面仍有題目，請繼續作答)

8. (a) 以工程實務觀點，設計零件時，宜考慮那些因素(或是那些評估項目)，作為選該零件用之材料的依據。請舉實例說明。 (15%)
(b) 設計完成之零件圖，其內容應包含那些資料，請列舉各項目？ (10%)

(a) 機械製造：

9. (a)試說明(1)刀具磨耗有哪些種類及其形成原因及(2)泰勒式之刀具壽命方程式。(10%)
(b)探討加工製程成本(cost per piece)最佳化一般會考慮加工成本、刀具成本、刀具更換成本、非生產成本及總成本等五項。某一零件之切削速度與各成本關係如下圖所示。寫下圖中 A, B, C, D, E 各曲線代表之成本為何。(15%)



10. (a)從材質成分、機械性質及可鑄造性說明鑄鐵和鑄鋼有何不同。(10%)
(b)說明脫臘鑄造法(Lost wax or Investment Casting)及壓鑄法(Die Casting)之製程，及其優缺點。(15%)

(b) 自動控制：

11. What is a PID control? How can you implement the controller by using OP (Operational Amplifier)? What are the control actions in a position control system? (25%)

12. Use a flowchart to describe a general procedure for designing and implementing an industrial feedback control system. (25%)