

國立虎尾科技大學九十七學年度研究所（碩士班）入學試題

所別：自動化工程系碩士班

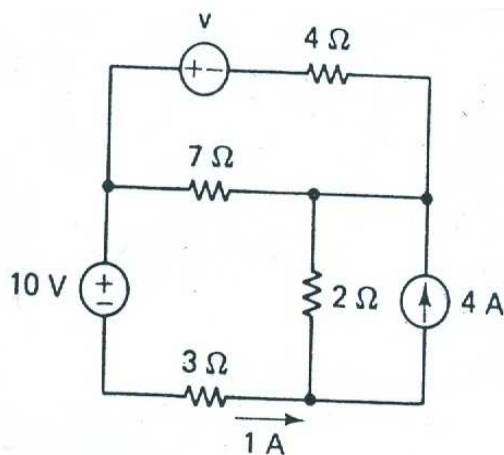
科目：考試科目 2（專業科目）

注意事項：

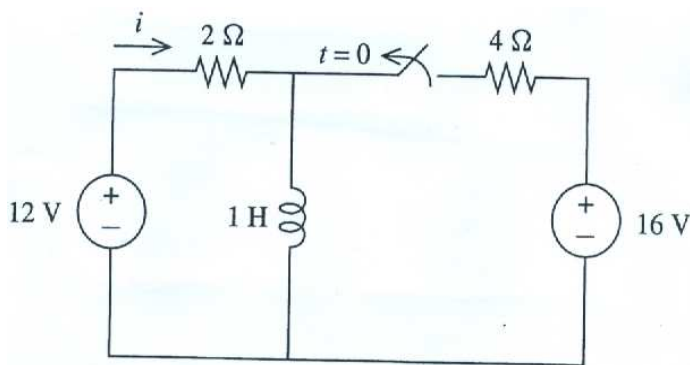
- (1) 本試題共有二十題，任選五題作答，每題二十分，合計一百分。
- (2) 答案卷上須註明選答題號，作答題數超過規定時，僅採作答順序較前之題目計分。

電路學

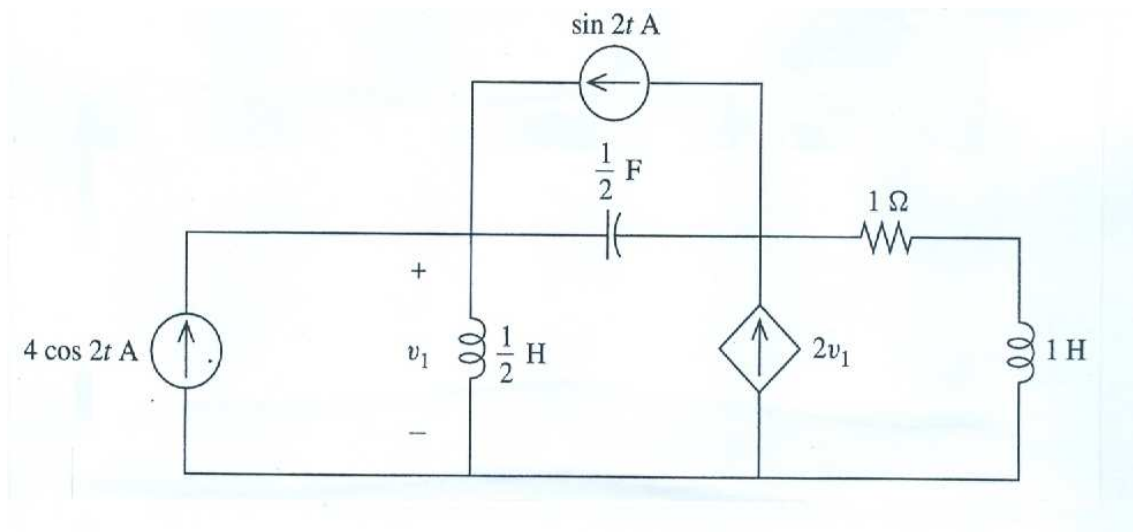
1. 試求下圖電路的 v 值。



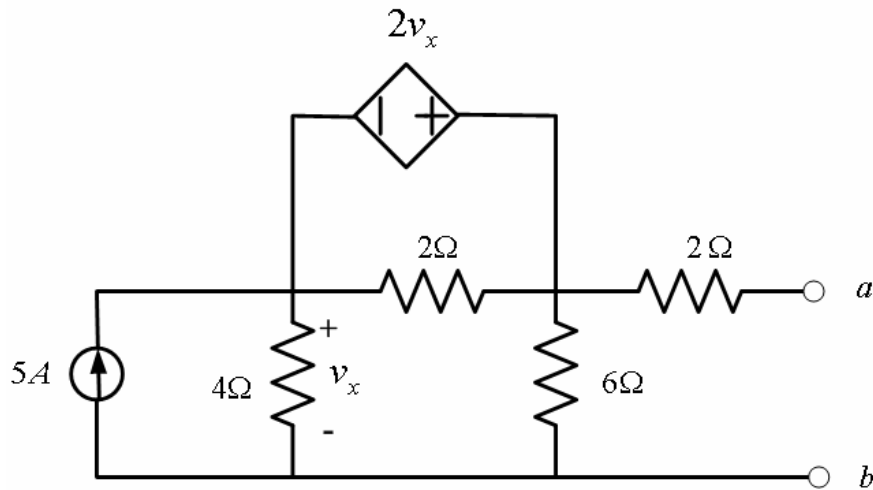
2. 如下圖，電路在 $t < 0$ 時開關閉合，電路呈直流穩態， $t = 0$ 時開關打開，試求 $t > 0$ 之電流 i 。



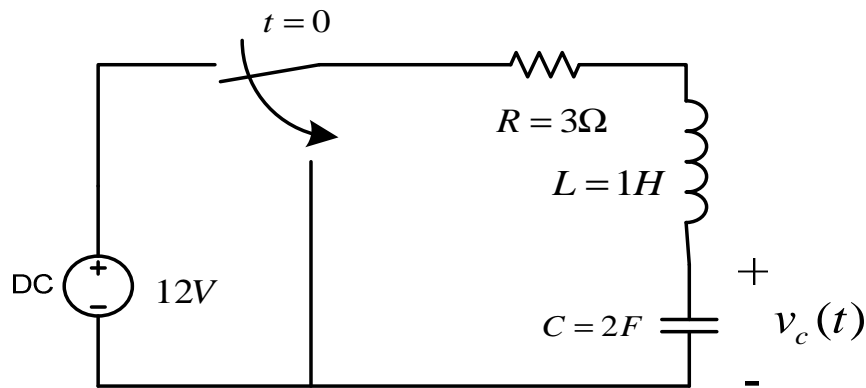
3. 試求下圖電路 v_1 的交流穩態值。



4. 試求下圖電路中，由 a、b 兩點看進去之戴維寧等效電路(Thevenin Equivalent Circuit)及諾頓等效電路(Norton Equivalent Circuit)。

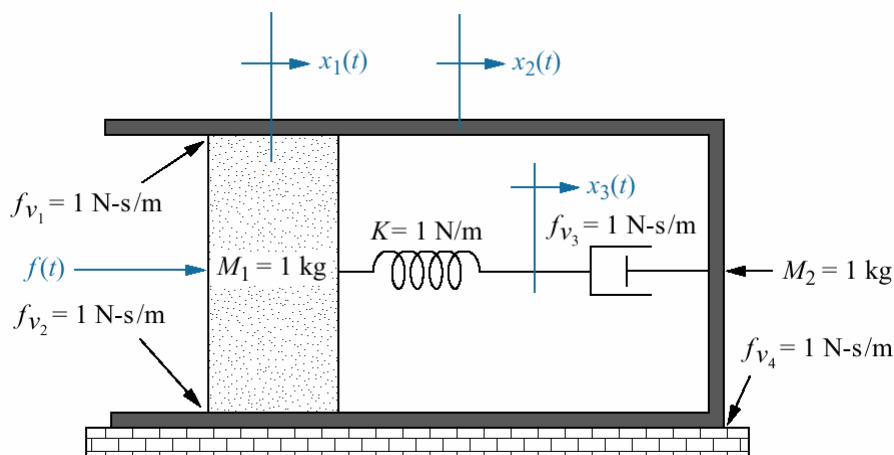


5. 如下圖，電路在 $t < 0$ 時開關在水平方向閉合，電路呈直流穩態， $t = 0$ 時開關向下閉合，試求 $t > 0$ 時 $v_c(t)$ 的完全響應。



自動控制

6. 求下圖中所示系統的轉移函數， $\frac{X_2(s)}{F(s)}$



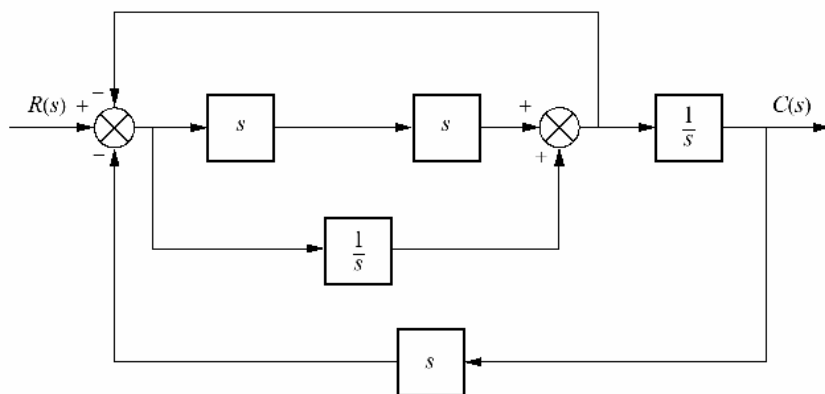
7. 有一單位回授系統，其順向轉移函數為 $G(s) = \frac{K(s-3)}{s^2 + 2s + 10}$ ，試繪 K 值由零變化到無限大時的根軌跡圖。

8. 假設一個系統之轉移函數為 $G(s) = \frac{100}{s^2 + 16s + 100}$ ，給予步階輸入，求峰值時間 (T_p)、超越量百分比 (%OS)、安定時間 (T_s)。

9. 已知閉迴路轉移函數為 $T(s)$ ，(a) 試問分別有多少閉迴路極點位於左半平面、右半平面及虛軸 $j\omega$ 上，(b) 試判斷此系統的穩定度，並簡述

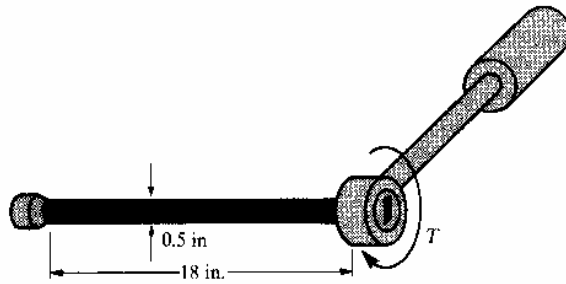
判斷的理由。 $T(s) = \frac{s^2 + 4s + 3}{s^6 + 6s^5 + 11s^4 + 18s^3 + 20s^2 - 24s - 32}$

10. 化簡以下之方塊圖求得轉移函數 $\frac{C(s)}{R(s)}$

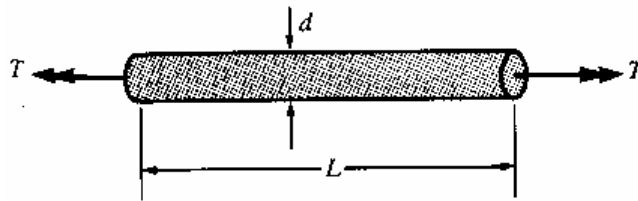


材料力學

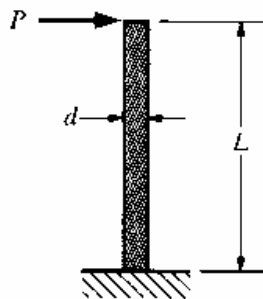
11. 有一鋼製套統扳手用之套統，其直徑為 0.5 英吋而長為 18 英吋(如圖)，如果此鋼材之容許剪應力為 11Kpsi，則此扳手之最大容許扭力 T 為多少？而此時套統之扭角 ϕ 為多少？($G = 11.8 \times 10^6$ psi，忽略套統之彎曲)



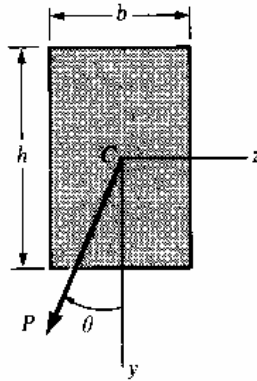
12. 有一直徑為 12mm 之高強度鑽桿 ($G = 80$ GPa) 承受一扭力 T (如圖)，其容許剪應力為 300MPa，請問若要其產生 180° 扭角而不超過其容許剪應力之最小長度 L 為多少？



13. 有一長度為 2m 直徑為 150mm 之圓柱其端部承受一 2.5kN 之橫向集中力，求其內部最大剪應力與最大正交應力。



14. 一長度為 L 矩形木製懸臂樑其端點承受一集中力 P 如圖，請計算其所受之最大拉應力？其相關數據為： $b = 75\text{mm}$ ， $h = 150\text{mm}$ ， $L = 1.4\text{m}$ ， $P = 800\text{N}$ ， $\theta = 30^\circ$ 。

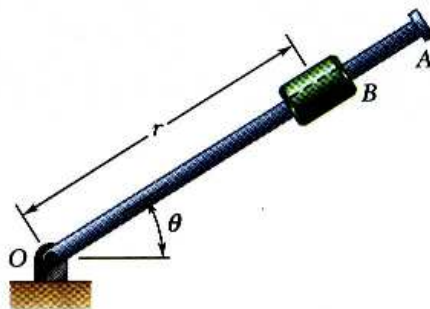


15. 有一直徑 150mm 之柱狀混凝土試件，其最大壓應力為 24MPa ，其最大剪應力為 10MPa ，當測試壓力為多少時此試件會碎裂？

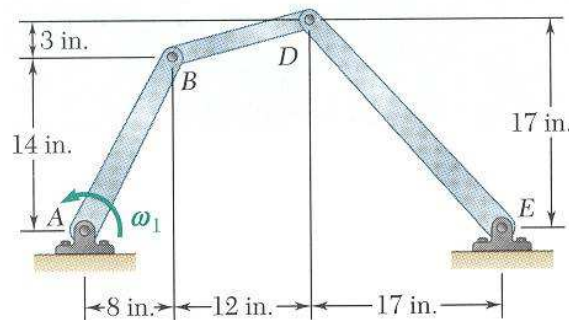


動力學

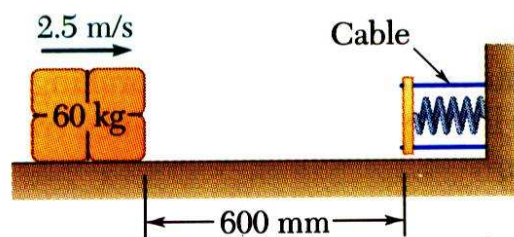
16. Rotation of the arm about O is defined by $q = 0.15t^2$ where q is in radians and t in seconds. Collar B slides along the arm such that $r = 0.9 - 0.12t^2$ where r is in meters. After the arm has rotated through 30° , determine (a) the total velocity of the collar, (b) the total acceleration of the collar, and (c) the relative acceleration of the collar with respect to the arm.



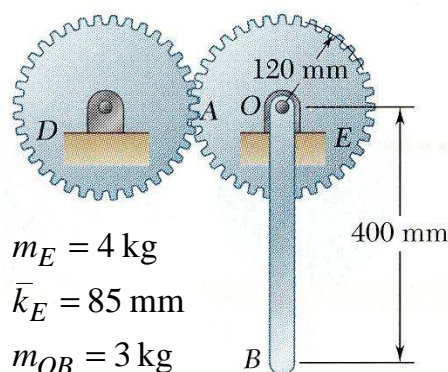
17. In the position shown, crank AB has a constant angular velocity $\omega_1 = 20 \text{ rad/s}$ counterclockwise. Determine the angular velocities and angular accelerations of the connecting rod BD and crank DE .



18. A spring is used to stop a 60 kg package which is sliding on a horizontal surface. The spring has a constant $k = 20 \text{ kN/m}$ and is held by cables so that it is initially compressed 120 mm. The package has a velocity of 2.5 m/s in the position shown and the maximum deflection of the spring is 40 mm. Determine (a) the coefficient of kinetic friction between the package and surface and (b) the velocity of the package as it passes again through the position shown.



19. The portion AOB of the mechanism is actuated by gear D and at the instant shown has a clockwise angular velocity of 8 rad/s and a counterclockwise angular acceleration of 40 rad/s^2 . Determine: (a) tangential force exerted by gear D , and (b) components of the reaction at shaft O .



20. The dumbwaiter D and its load have a combined weight of 600 N, while the counterweight C weighs 800 N. Determine the power delivered by the electric motor M when the dumbwaiter (a) is moving up at a constant speed of 8 m/s and (b) has an instantaneous velocity of 8 m/s and an acceleration of 2.5 m/s^2 , both directed upwards.

