

108 學年度四技二專第四次聯合模擬考試 電機與電子群 專業科目(一) 詳解

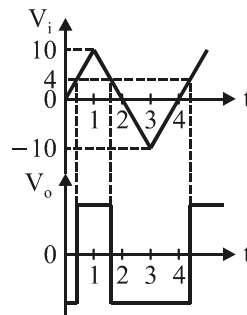
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|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| C | B | A | D | A | B | B | C | D | A | D | C | C | A | B | D | A | B | B | D | C | C | A | D | D |
| 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| B | D | C | A | C | A | B | A | D | A | C | D | B | C | B | B | C | C | D | D | B | A | C | D | A |

第一部分：電子學

1. $T = 1 \text{ ms}$, $1 \text{ ms} : t = 360^\circ : 45^\circ$
 $\therefore t = \frac{1}{8} \text{ ms} = 0.125 \text{ ms}$
2. 不管 P 或 N 型半導體，溫度 ↑，電子和電洞濃度皆增加
3. $V_i = 0$, D_1 、 D_4 ON , D_2 、 D_3 OFF
 $V_o = -12 \text{ V} \times \frac{4 \text{ k}}{8 \text{ k} + 4 \text{ k}} = -4 \text{ V}$
4. N_1 為 100 V $\therefore N_2$ 為 50 V , N_3 為 25 V
 $\text{PIV} = 50 + 25 = 75 \text{ V}$
5. n 個二極體，n 個電容，n 倍的倍壓
6. $V_C = 10 \text{ V}$ \therefore 稽納 OFF , $V_o = V_C = 10 \text{ V}$
7. CB 式 R_i 小，會使送到 CB 式輸入端的訊號衰減太大
8. (A) 是 E 極
(B) 濃度降低
9. $m = -\frac{1}{R_C}$ $\therefore R_C$ 不變，m 不變
10. 負半週截掉，表示 $V_{CE} \downarrow$ $\therefore I_C \uparrow$, $I_C = \beta I_B$
 $\therefore \beta$ 太大
11. (1) $I_B = \frac{5 - 0.7}{5 \text{ k} + (1 + 100) \times 1 \text{ k}} \cong 40 \mu\text{A}$
 (2) $I_C = 100 \times 40 \mu\text{A} = 4 \text{ mA}$
 (3) $I_{C(\text{sat})} = \frac{10 - 0.2}{2 \text{ k} + 1 \text{ k}} = 3.26 \text{ mA}$
 (4) $I_C > I_{C(\text{sat})}$ ，進入飽和區 $\therefore A_V = 0$
12. $\frac{V_o}{V_i} = \frac{-\beta \times 2 \text{ k}}{2 \text{ k}} = -100$ $\therefore \beta = 100$
13. ① $V_s = 2.7 \text{ V}$ 時， $I_B = (2.7 - 0.7) \div 10 \text{ k} = 0.2 \text{ mA}$
 $I_C = 20 \text{ mA}$, $V_{o(\text{dc})} = 10 - 20 \text{ m} \times 0.2 \text{ k} = 6 \text{ V}$
 ② $A_V = \frac{V_o}{V_s} = \frac{i_c \times 0.2 \text{ k}}{i_b \times 12 \text{ k}} = \frac{20}{12} = \frac{V_o}{1}$, $V_o = \frac{5}{3}$
 $\therefore V_o = 6 \pm \frac{5}{3} \div 4.3 \sim 7.7 \text{ V}$
14. (A) CC 放大組態 $A_V = 1$ $\therefore 20 \log 1 = 0 \text{ dB}$
15. $\frac{V_o}{V_i} = \frac{-i_{c2} \times 2 \text{ k}}{i_{b2} \times 1 \text{ k} + i_{c2} \times 1 \text{ k}} \times \frac{-i_{c1} \times [4 \text{ k} // [1 \text{ k} + 1 \text{ k}(1 + \beta)]]}{i_{b1} \times 1 \text{ k} + i_{c1} \times 1 \text{ k}}$
 $\cong 2 \times 4 = 8$

16. S 夾止，即 $I_D = 0$
17. (A) $V_{GS} > 0$, I_D 不一定為 0
18. ① $V_{GS} = V_G - V_S = 0 - I_D \times 1 \text{ k}$
 ② $I_D = 4 \text{ m}(1 - \frac{-I_D \times 1 \text{ k}}{2})^2 \Rightarrow V_{GS} = -1 \text{ V}$, $I_D = 1 \text{ mA}$
 ③ $g_m = \frac{2I_{DSS}(1 - \frac{V_{GS}}{V_P})}{|V_P|} = 2 \text{ mS}$
 ④ $A_V = g_m \times 10 \text{ k} = 20$
21. $V_o = V_i = 15 \text{ V}$
 $\therefore 15 > 12 \therefore V_o = 12 \text{ V}$
22. $\text{DT}\% = \frac{10 - 4}{10 - (-10)} = \frac{3}{10} = 30\%$

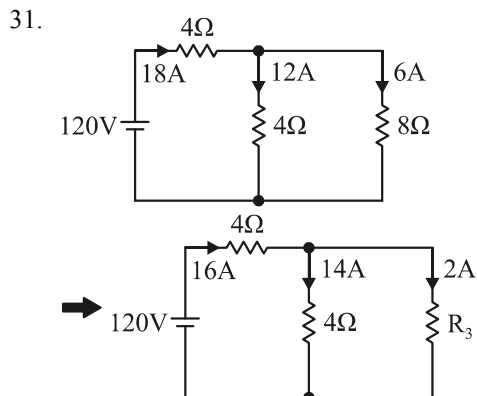


23. $\text{DT}\% = \frac{10 \text{ k} \times 1 \mu}{10 \text{ k} \times 1 \mu + 40 \text{ k} \times 1 \mu} = 20\%$
24. ① $V_+ = \pm 12 \text{ V} \times \frac{20 \text{ k}}{20 \text{ k} + 40 \text{ k}} = \pm 4 \text{ V}$
 $\therefore V_i = -6$ 時， $V_o = 12$, $V_+ = 4$
 ② $V_i = 5 \text{ V}$ 時， $V_i > V_+$ $\therefore V_o = -12$

第二部分：基本電學

27. $\alpha_{50} = \frac{1}{\frac{1}{+50} + 50} = \frac{1}{300}$, $\frac{1}{\alpha_0} = -T_o = 300 - 50$
 $\therefore T_o = -250^\circ\text{C}$
28. V_T 為所有電阻的電壓降， R_T 為總電阻， I_T 為總電流
 $V_T = 120 - 60 = 60 \text{ V}$, $R_T = 60 \Omega$, $I_T = 1 \text{ A}$
 $I = 1 \times \frac{30}{30 + 60} = \frac{1}{3} \text{ A}$
29. 可變電阻由 A 移至 B，電阻值變小，流過安培計的電流量減少，故指示值降低

30. $R_{ab} = [(24 // 8) + 1 + 1] // 8 = 4 \Omega$

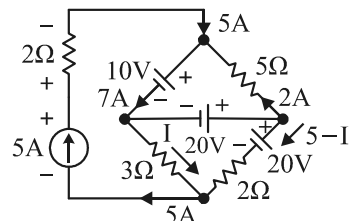


$\therefore 4 \times 14 = 2 \times R_3, R_3 = 28 \Omega$

32. ① $20 + 3I = 2(5 - I) + 20, I = 2 \text{ A}$

② 5A 上的電壓 = $2 \Omega \times 5 \text{ A} + 10 \text{ V} + 3 \times I = 26 \text{ V}$

③ $\therefore P = 26 \times 5 = 130 \text{ W}$

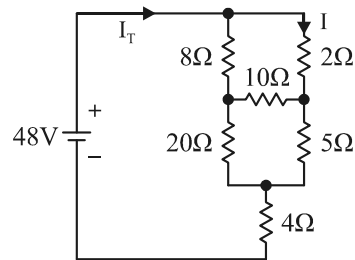


33. ① 平衡電橋，拆除 10Ω

② $R_T = [(20 + 8) // (5 + 2)] + 4 = 9.6 \Omega$

③ $I_T = \frac{48 \text{ V}}{9.6 \Omega} = 5 \text{ A}$

④ $I_1 = 5 \times \frac{28}{28 + 7} = 4 \text{ A}$



34. $C_1 + C_2 = 2000$

$\therefore \frac{1}{C_1} + \frac{1}{2000 - C_1} = \frac{1}{375}$

$C_1^2 - 2000C_1 + 750000 = 0, (C_1 - 1500)(C_1 - 500) = 0$

$C_1 = 1500$ 或 $500 \therefore$ 電容值為 $1500 \mu\text{F}$ 及 $500 \mu\text{F}$

35. $Q = -5 \times (50 - 100) = 250$ 焦耳

36. $L_T = 5 + 4 + 6 + 2 \times 2 = 19 \text{ H}$

$W = \frac{1}{2} \times 19 \times 4^2 = 152$ 焦耳(J)

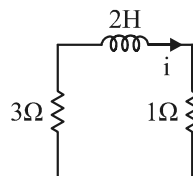
37. ① $E = L \frac{\Delta i}{\Delta t} = 4 \times \frac{5 - 2}{1} = 12 \text{ V}$

$\therefore i \uparrow \therefore a$ 點為正，故 d 點為正

② $E_{cd} = M \frac{\Delta i}{\Delta t} = 3 \times \frac{2 - 5}{1} = -9 \text{ V}$

38. ① SW open, $i = 10 \times \frac{4}{4 + 1} = 8 \text{ A}$

② SW close, $i = 8 e^{-\frac{4}{2}t} = 8 e^{-2t}$



39. 穩態後，電容如同開路

$\therefore V_{C1} = V_{C2} = 10 \text{ V}, \frac{V_{C1}}{V_{C2}} = 1$

40. $f = \frac{P_n}{120} = \frac{8 \times 2400}{120} = 160 \text{ Hz}$

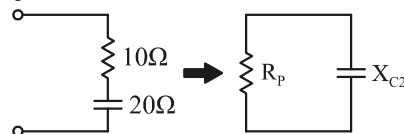
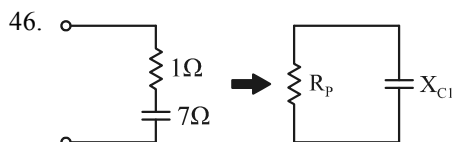
41. $I_{rms} = \sqrt{\left(\frac{4}{\sqrt{2}}\right)^2 + \left(\frac{-3}{\sqrt{2}}\right)^2 + \left(\frac{5}{\sqrt{2}}\right)^2 + (-5)^2} = 5\sqrt{2}$

42. $100\sqrt{2} = 141 \text{ V}$

43. $\sqrt{4^2 + (7 - 4)^2} = 5 \text{ A}$

44. $Z_{ab} = j20 // (-j20) = \infty \therefore \bar{V}_{ab} = 120 \text{ V} \angle 0^\circ \text{ V}$

45. $628t = 2\pi ft, f = 100$ ，但電源 f 為功率 f 的一半
 $\therefore f = 50 \text{ Hz}$



$X_{C1} = \frac{1^2 + 7^2}{7} = \frac{50}{7} \Omega, X_{C2} = \frac{10^2 + 20^2}{20} = 25 \Omega$

$\frac{f_2}{f_1} = \frac{X_{C1}}{X_{C2}} = \frac{\frac{50}{7}}{25} = \frac{2}{7}$

47. $P_{max} = \frac{100^2}{10} = 1000 \text{ W}$

48. (C) V_R 最多為 100 V

49. $I_p = \frac{100\sqrt{3}}{10} = 10\sqrt{3}, I_L = 30 \text{ A}$

$P = \sqrt{3} V_L I_L \cos \theta = \sqrt{3} \times 100 \times \sqrt{3} \times 30 \cos 60^\circ = 4500 \text{ W}$

50. 各相皆相差 120°