

103 學年度四技二專第三次聯合模擬考試

電機與電子群電機類 專業科目(二) 詳解

103-3-03-5

| | | | | | | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 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 |
| A | C | B | B | D | A | D | D | B | C | C | D | A | C | D | B | C | A | B | A | D | C | B | A | C |
| 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 |
| D | B | B | A | B | A | C | A | D | C | C | A | D | D | A | C | B | D | C | C | B | C | A | B | C |

第一部分：電工機械

- $e = B \times \ell \times v \times \sin \theta$, $10 = 1 \times 0.25 \times 0.8 \times v \times 0.5$
25 公分要改成 0.25 公尺計算 , $v = 100 \text{ m/s}$
- $a = mp = 1 \times 4 = 4$
 $F_A = \frac{I_a}{a} \times \frac{Z}{2} \times \frac{1}{P} = \frac{120}{4} \times \frac{144}{2} \times \frac{1}{4} = 540 \text{ AT}$
 $F_C = F_A \times \frac{\theta_p - 2\alpha}{\theta_p} = 540 \times \frac{90 - 2 \times 15}{90} = 360 \text{ AT}$
因題目問的是一對磁極之交磁安匝數
 $\therefore 360 \times 2 = 720 \text{ AT}$
- $a = mp = 1 \times 4 = 4$, $Z = 300 \times 2 = 600$
 $a = 2m = 2 \times 2 = 4$
 $E = \frac{PZ\phi n}{60a} = \frac{4 \times 600 \times 0.02 \times 1200}{60 \times 4} = 240 \text{ V}$
 $V = E - I_a R_a = 240 - 0.1 \times 250 = 215 \text{ V}$
- $I_s = 8 \times 2 = 16$, $I_s = \frac{V - E_b}{R_a + R_x}$, 啓動瞬間 $E_b = 0$
 $16 = \frac{100 - 0}{0.5 + R_x}$, $R_x = 5.75$
- $E_b = V - I_a R_a = 180 - 100 \times 0.2 = 160 \text{ V}$
若電樞兩端改爲 120 V 時
 $E_b = 120 - 100 \times 0.2 = 100 \text{ V}$
已知 $n = k' \frac{E_b}{\phi}$, k' 、 ϕ 均爲定值
 $\therefore n$ 與 E_b 成正比 , $\frac{160}{100} = \frac{1200}{n}$, $n = 750 \text{ rpm}$
- $P_o = V_1 \times I_o \times \cos \theta_o$, $480 = 1200 \times 0.5 \times \cos \theta_o$
 $\cos \theta_o = 0.8$, $\therefore \sin \theta_o = 0.6$
 $I_m = I_o \times \sin \theta_o = 0.5 \times 0.6 = 0.3$
- $N_s = \frac{120f}{P} = \frac{120 \times 60}{6} = 1200$
 $S = \frac{N_s - N_r}{N_s} \times 100\% = \frac{1200 - 1140}{1200} = 5\%$
 $f_2 = sf_1 = 0.05 \times 60 = 3 \text{ Hz}$
- $V - V$ 接線之總容量爲：
 $S = 0.866 \times 10 \times 2 = 17.32 \text{ KVA}$
負擔 25 KVA , 因此過載 $25 - 17.32 = 7.68 \text{ KVA}$
- $\varepsilon\% = p \cos \theta + q \sin \theta$

$$S = V_1 I_1 = V_2 I_2 , 5 \text{ KVA} = 200 \times I_2 , I_2 = 25$$

$$p = \frac{I_2 \times R_{02}}{V_2} = \frac{25 \times 0.14}{200} = 0.0175$$

$$q = \frac{I_2 \times X_{02}}{V_2} = \frac{25 \times 0.16}{200} = 0.02$$

$$\varepsilon\% = 0.0175 \times 0.8 + 0.02 \times 0.6 = 2.6\%$$

$$16. N_s = \frac{120f}{P} = \frac{120 \times 60}{6} = 1200$$

滿載時之轉差率爲：

$$S = \frac{N_s - N_r}{N_s} \times 100\% = \frac{1200 - 1152}{1200} = 4\%$$

900 rpm 時之轉差率爲：

$$S = \frac{N_s - N_r}{N_s} \times 100\% = \frac{1200 - 900}{1200} = 25\%$$

因轉矩不變，因此可利用比率推移公式：

$$\frac{R_2}{S_1} = \frac{R_2 + R_x}{S_2} , \frac{R}{4\%} = \frac{R + R_x}{25\%}$$

$$25R = 4R + 4R_x , R_x = \frac{21}{4}R = 5.25R$$

$$17. N_s = \frac{120f}{P} = \frac{120 \times 60}{4} = 1800$$

$$P_o = 5 \times 746 = 3730 , P_m = 3730 + 170 = 3900$$

$$P_2 = P_{c2} + P_m = 3900 + 100 = 4000$$

$$\frac{P_2}{1} = \frac{P_{c2}}{S} = \frac{P_m}{1-S} , \frac{4000}{1} = \frac{100}{S} , S = 2.5\%$$

$$N_r = N_s(1-S) = 1755 \text{ rpm}$$

18. Y- Δ 啓動時，啓動電流與啓動轉矩均爲直接啓動之 $\frac{1}{3}$ 倍

$$T_s = \frac{1}{3} \cdot 30 = 10 \text{ nt-m}$$

$$I_s = \frac{1}{3} \cdot 60 = 20 \text{ A}$$

$$19. P_A + P_B = 30 , \frac{P_A}{P_B} = \frac{S_A}{S_B} \times \frac{\%Z_B}{\%Z_A} = \frac{10}{30} \times \frac{3\%}{4\%} , \frac{P_A}{P_B} = \frac{1}{4}$$

$$\therefore 4P_A = P_B , P_A = 6 \text{ KVA} , P_B = 24 \text{ KVA}$$

第二部分：電子學實習

21. 丙類火災是由通電中之電力設施或電氣設備所引起的火災

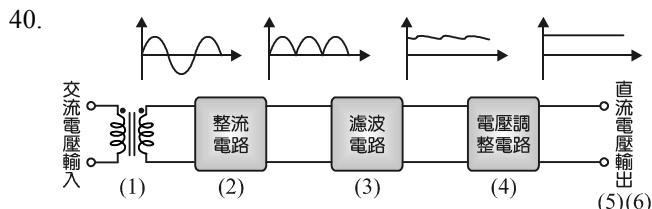
22. $I = \frac{3 - 0.6 - (-3)}{2\text{ k}} = 2.7\text{ mA}$
23. $V_{10\text{k}\Omega} = 30\text{ V} \times \frac{10\text{ k}\Omega}{20\text{ k}\Omega + 10\text{ k}\Omega} = 10\text{ V}$
 $\because V_{10\text{k}\Omega} < V_Z, \therefore$ 稽納二極體未崩潰
 $V_o = V_{10\text{k}\Omega} = 10\text{ V}$
24. 二極體方向往上，波形往上移動，最低電壓為 10 V，最高為 35 V
25. PNP 電晶體，黑棒接 B 極且紅棒接 C 極時，呈逆向截止，指針不偏轉；若反接時，B 極接負壓，C 極接正壓，呈順向導通，則指針偏轉
26. $10 - I_2 \times 1\text{ k} - I_1 \times 3.6\text{ k} - 0.5 = 0, I_2 = I_1 + 5I_B$
 $I_1 = I_B + 0.5\text{ m}, I_B = 0.75\text{ mA}$
27. $V_{th} = \frac{\frac{20}{8\text{ k}} + \frac{-20}{2\text{ k}}}{\frac{1}{8\text{ k}} + \frac{1}{2\text{ k}}} = -12\text{ V}, R_{th} = 8\text{ k} // 2\text{ k} = 1.6\text{ k}\Omega$
 $-12 - I_B \times 1.6\text{ k} - 0.6 - I_E \times 3.7\text{ k} + 20 = 0$
 $I_B = 20\text{ }\mu\text{A}, I_C = 2\text{ mA}$
 $V_C = 20 - 2\text{ m} \times 2.7\text{ k} = 14.6\text{ V}$
28. $12.7 - I_E \times 4\text{ k} - 0.7 - I_B \times 896\text{ k} = 0, I_E = 1.25\text{ mA}$
 $r_e = \frac{25\text{ m}}{1.25\text{ m}} = 20\text{ }\Omega, r_\pi = 3.2\text{ k}\Omega$
 $\frac{V_o}{V_i} \doteq \frac{3.2\text{ k}}{3.2\text{ k} + 0.8\text{ k}} \times \frac{-6\text{ k} // 3\text{ k}}{20} = -80$
29. $\frac{V_o}{V_i} \doteq \frac{2\text{ k}}{10} = 200$
30. 兩級間串接是以直接耦合方式連接
31. 當 $V_{GS} = 0\text{ V}$ 時， $I_D = I_{DSS}$ ，故選(A) P_1
32. $\because I_G = 0, V_{DS} = V_{GS}$
 $I_D = \frac{24 - V_{GS}}{6\text{ k} + 3\text{ k}} = 0.125\text{ m} \times (V_{GS} - 2)^2$
 $24 - V_{GS} = \frac{9}{8}(V_{GS} - 2)^2, \therefore V_{GS} = V_{DS} = 6\text{ V}$
 $g_m = 2 \times 0.125\text{ m} \times (6 - 2) = 1\text{ m}\overline{\Omega}$
 $\frac{V_o}{V_i} = 1\text{ m} \times (6\text{ k} // 12\text{ k}) = 4$
33. $I_D = 2\text{ m} = 0.5\text{ m} \times (V_{GS} - 1)^2, \therefore V_{GS} = 3\text{ V}$
 $g_m = 2 \times 0.5\text{ m} \times (3 - 1) = 2\text{ m}\overline{\Omega}$
 $\frac{V_o}{V_i} = -2\text{ m} \times 2\text{ k} = -4$
34. $V_{UT} = 12 \times \frac{2\text{ k}}{4\text{ k} + 2\text{ k}} = 4\text{ V}$
 $V_{LT} = -12 \times \frac{2\text{ k}}{4\text{ k} + 2\text{ k}} = -4\text{ V}$
 若 $V_A = -5\text{ V}$ 則輸出正飽和， $V_o = +12\text{ V}$
35. $V_o = \frac{-10\text{ k}}{1\text{ k}} \times 1 = -10\text{ V}$

第三部分：基本電學實習

36. $T = \frac{1}{f} = \frac{RC}{5} = 0.2RC = 0.2\tau, \frac{T}{2} = 0.1\tau$

電容器充放電期間($\frac{T}{2}$)遠小於電路時間常數(τ)，故 V_B 波形為近似三角形

39. 此接法可測量兩手間人體的電阻值，但所得電阻值應遠大於此處的測量值



41. 三路開關共 3 條線，另開關盒為鉛鑄式，應使用 2.0 mm² 綠色線接地，因此②號管路共有 4 條線

42. D 管：排水用管，E 管：導線用管，O 管：工業用管，W 管：自來水用管

45. 利用電橋平衡可得： $V_a = V_b, R = \rho \frac{\ell}{A} \rightarrow$ 電橋平衡

時， $(12\Omega)(\frac{\rho}{A} X) = (4\Omega)[\frac{\rho}{A}(40 - X)], 12X = 4(40 - X)$

$16X = 160, X = 10\text{ km}$

48. 精密等級 1.0 級表示誤差為滿刻度的 $\pm 1\%$ ，所以滿刻度為 100 V 時，誤差為 $\pm 1\text{ V}$ ，指示值為 70 V 時，測量值的範圍在 70 V $\pm 1\text{ V}$