113 學年度科技校院四年制與專科學校二年制

統一入學測驗公告答案

考科代碼：4-03-1、4-04-1

類　　別：電機與電子群電機類、電機與電子群資電類

考　　科：專業科目(一)基本電學、基本電學實習、電子學、電子學實習

題號	答案	題號	答案	題號	答案	題號	答案	題號	答案	題號	答案
1	B	11	B	21	D	31	D	41	C	51	
2	A	12	A	22	B	32	A	42	B	52	
3	C	13	D	23	A	33	D	43	D	53	
4	C	14	C	24	D	34	A	44	D	54	
5	B	15	B	25	A	35	C	45	D	55	
6	C	16	A	26	A	36	A	46	C	56	
7	B	17	C	27	B	37	A	47	B	57	
8	C	18	B	28	D	38	C	48	C	58	
9	A	19	C	29	A	39	A	49	B	59	
10	D	20	D	30	D	40	C	50	A	60	

1. $V_{c\to b}=Q(V_b-V_c)$

$-20=Q(10-20) \quad \Rightarrow Q=2C$

$V_{a\to b}=Q(V_b-V_a)$

$64=2(10-V_a) \quad \Rightarrow V_a=-22V$

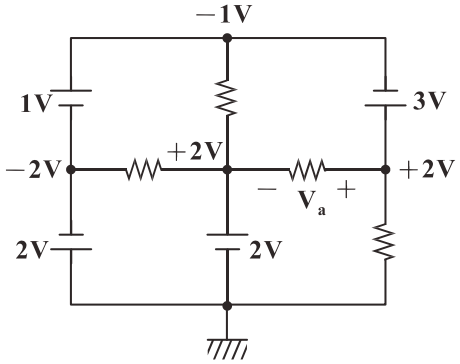
$V_{ca}=V_c-V_a=20-(-22)=42V$

2. $20℃ \begin{cases} 20℃ & 10\Omega \\ 40℃ & 11\Omega \end{cases} \begin{matrix} \\ \end{matrix} \begin{matrix} \triangle R \\ 1\Omega \end{matrix}$

$40℃ \begin{cases} 40℃ & 11\Omega \\ 80℃ & 13\Omega \end{cases} \begin{matrix} \\ \end{matrix} \begin{matrix} \\ 2\Omega \end{matrix}$

$$\frac{\triangle R}{\triangle t}=\frac{1}{20}=\frac{2}{40}$$

3. $V_a=2-2=0V$



4. 電橋平衡 $4\times12=12\times4$

$$R_T=1+12//(4+4)//(12+12)=1+\frac{24}{2+3+1}=1+4=5\Omega$$

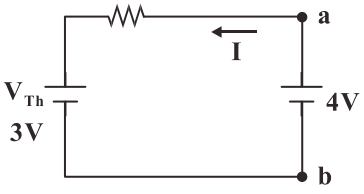
$$I=\frac{10}{5}=2A$$

5. $I_1 : I_2 : I_3 = \frac{V_S}{6} : \frac{V_S}{10} : \frac{V_S}{R} = 5 : 3 : 2$

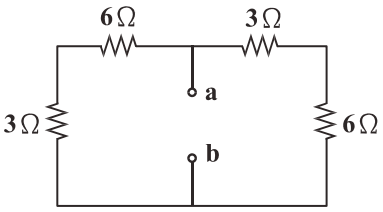
$\therefore V_S = 30V$

$R = \frac{30}{2} = 15\Omega$

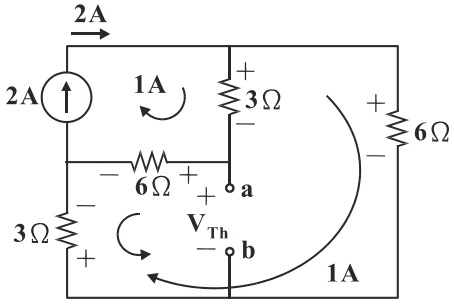
6. $R_{Th} = 4.5\Omega$



$R_{Th} = (3+6)//(3+6) = 4.5\Omega$



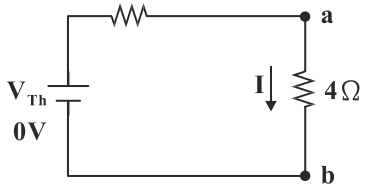
$V_{Th} = 6 \times 1 - 3 \times 1 = 3V$



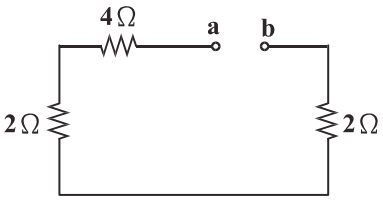
$I = \frac{4-3}{4.5} = \frac{2}{9}A$

$P = 4 \times \frac{2}{9} = \frac{8}{9}W = 0.89W$(提供)

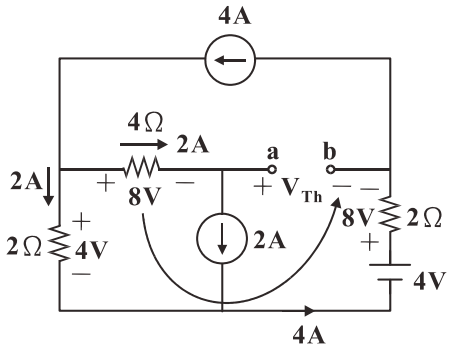
7. $R_{Th}=8\Omega$



$R_{Th}=4+2+2=8\Omega$



$V_{Th}=-8+4-4+8=0V$，$I=0A$



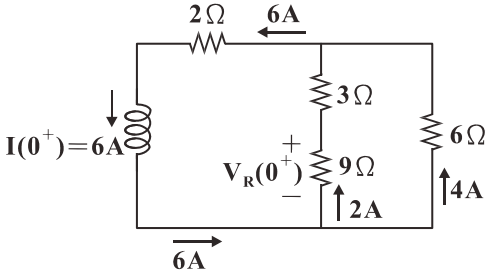
8. $R_{Th}=3\Omega$

$V_{Th}=2\times3+12=18V$

9. $W_T=\frac{1}{2}L_TI^2=\frac{1}{2}(4+6+8-2\times3-2\times5+2\times4)\times2^2=20J$

10. $t=0^-$ $I(0^-)=\frac{12}{2}=6A$

$t=0^+$



$V_R(0^+)=-6\times\frac{6}{12+6}\times9=-18V$

11. $i(t)=-5\cos(100t+30^\circ)$

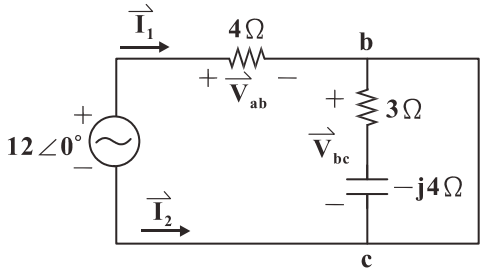
$=5\sin(100t-60^\circ)$

$-30^\circ-(-60^\circ)=+30^\circ$

V 超前 I 30°

12. $V_{av}=\frac{15\times3}{3+2}=9V$

13. $j5+(-j5)=0\,\Omega$



$$\vec{I}_1=\frac{12\angle 0^\circ}{4}=3\angle 0^\circ A$$

$$\vec{I}_2=-\vec{I}_1=3\angle 180^\circ A$$

$$\vec{V}_{ab}=12\angle 0^\circ V$$

14. 串 I 最大　⇒諧振時

$$f=240Hz \neq f_o \quad \begin{cases} X_L=160\,\Omega\times\frac{1}{2}\ \downarrow \\ X_C=40\,\Omega\times 2\ \uparrow \end{cases}$$

$$f_o=120Hz=240\times\frac{1}{2} \qquad X_{LO}=X_{CO}=80\,\Omega$$

15. $$BW=\frac{f_o}{Q}=\frac{\frac{1}{2\pi\sqrt{LC}}}{R\sqrt{\frac{C}{L}}}=\frac{1}{2\pi RC}$$

$$\frac{250}{\pi}=\frac{1}{2\pi\times 200\times C} \quad \Rightarrow C=10\,\mu F$$

$$Q=200\sqrt{\frac{10\times 10^{-6}}{1\times 10^{-3}}}=20$$

$$BW=\frac{f_o}{Q}=\frac{f_o}{20}=\frac{250}{\pi}$$

$$f_o=\frac{5000}{\pi}Hz=1592Hz$$

$$f_1=1592-\frac{\frac{250}{\pi}}{2}=1552Hz$$

$$f_2=1592+\frac{\frac{250}{\pi}}{2}=1632Hz$$

16. $\triangle\begin{cases} V_\ell = V_P = 25V \\ I_\ell = \sqrt{3}\ I_P = 8.66 = 5\sqrt{3}\ A \end{cases}$

$I_P = 5A$

$V_P = 5(3+j4) = 25V$

$P = 3V_P I_P \cos\theta = 3I_P^2 R_P = 3\times 5^2 \times 3 = 225W$

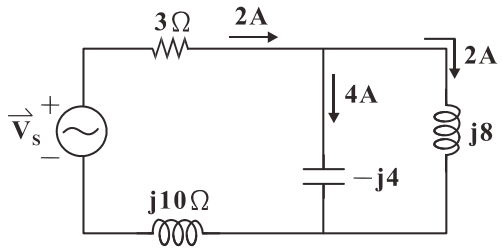
$Q = 3I_P^2 X_P = 3\times 5^2 \times 4 = 300VAR$

$S = 3\times 5^2 \times 5 = 375VA$

$\textcircled{V} = 5(3+j4) = 25V$

17. $\vec{Z} = 3+(-j4)//(j8)+j10 = 3+\dfrac{(-j4)(j8)}{-j4+j8}+j10 = 3-j8+j10 = 3+j2\,\Omega$

18.



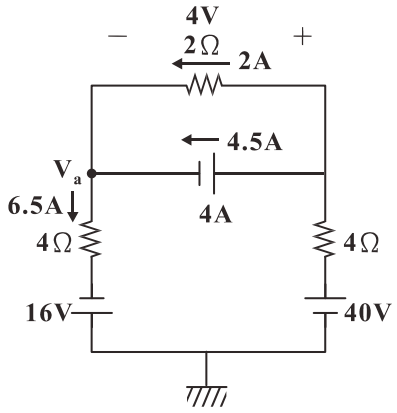
$\vec{S} = I^2\vec{Z} = 2^2(3+j2) = 12+j8 = 14.42\angle 56.31^\circ$

P.F.$= \dfrac{12}{14.42} = 0.83$(落後)L 性

19. $R = 250\times 10^{\circ}\,\Omega \pm 1\% = 250\,\Omega \pm 2.5\,\Omega$

$P = \dfrac{5^2}{250} = 0.1W$

20.



$V_a = (2+4.5)\times 4 - 16 = 10V$

21. $V_{PP}=2V_m=2\times6=12V$

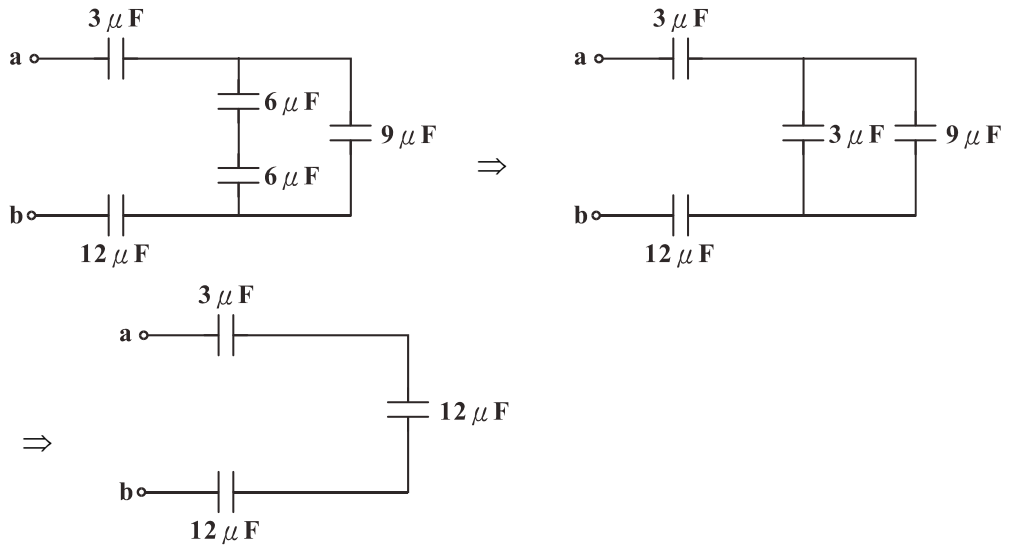
$\frac{12}{6}=2V/DIV$

$f=\frac{157}{2\pi}=25Hz$

$T=\frac{1}{f}=\frac{1}{25}$ 秒$=40$ 毫秒

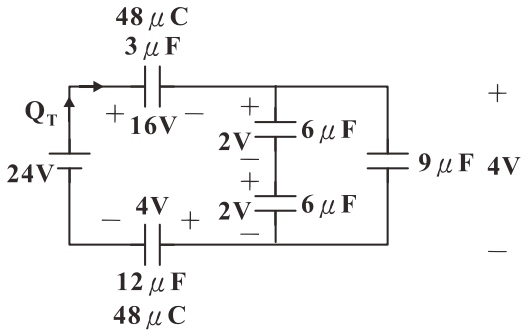
$\frac{40ms}{8}=5ms/DIV$

22.



$\frac{1}{C_{ab}}=\frac{1}{3}+\frac{1}{12}+\frac{1}{12}=\frac{1}{2}$，$C_{ab}=2\,\mu F$

23.



$Q_T=24\times2=48\,\mu C$

24. RL 並　⇒L 性

$i_s(t)$落後 $v_s(t)$ θ 角

$i_R(t)$與 $v_s(t)$同相

$i_L(t)$落後 $v_s(t)90^\circ$

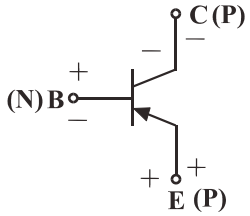
25. 指示燈接線脫落，指示燈與電熱線並聯。

26. $V_{o(av)}=110\times\frac{12}{110}\times\sqrt{2}\times\frac{2}{\pi}=\frac{24\sqrt{2}}{\pi}\text{ V}$

$\text{PIV}=1V_{2m}=110\times\frac{12}{110}\times\sqrt{2}=12\sqrt{2}\text{ V}$

27. 主動區—┌E－B：順向
└C－B：逆向

$\therefore V_E>V_B>V_C$



28. $\because \beta I_B=150\times 1\text{mA}=150\text{mA}$

$\therefore \beta I_B>I_C$，可知 BJT 飽和

29. $V_{BB}=12\times\frac{50\text{k}}{450\text{k}+50\text{k}}+(-12)\times\frac{450\text{k}}{50\text{k}+450\text{k}}=-9.6\text{V}$

$R_B=450\text{k}//50\text{k}=45\text{k}\Omega$

$I_B=\frac{V_{BB}-V_{BE}-V_{EE}}{R_B+(1+\beta)R_E}=\frac{-9.6-0.7-(-12)}{45\text{k}+(1+54)\times 1\text{k}}=0.017\text{mA}$

$I_C=\beta I_B=54\times 0.017\text{mA}=0.918\text{mA}$

$V_C=V_{CC}-I_CR_C=12-0.918\text{m}\times 5\text{k}=7.41\text{V}$

30. $A_V=\frac{V_o}{V_i}=-\beta\times\frac{R_C//R_{F2}}{r_\pi}=-100\times\frac{3\text{k}//68\text{k}}{1\text{k}}\fallingdotseq -287$

31. dB 值為負值，表示$|A_V|<1$　$\therefore |V_o|<|V_i|$

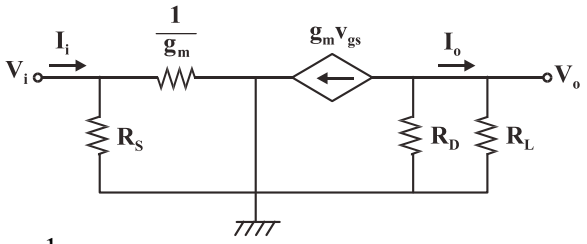
32. P 通道 MOSFET—┌基底為 N 型
└S 極與 D 極為 P 型

33. $A_V=\frac{V_o}{V_i}$

$=g_m(R_D//R_L)$

$=4\text{m}\times(2\text{k}//10\text{k})$

$=6.66$



$A_i=\frac{I_o}{I_i}=\frac{\frac{V_o}{R_L}}{\frac{V_i}{R_S//\frac{1}{g_m}}}=A_V\times\frac{R_S//\frac{1}{g_m}}{R_L}$

$=6.66\times\frac{1\text{k}//\frac{1}{4\text{m}}}{10\text{k}}=0.1332$

34. $V_{GS1}=V_{GG}=5V$

$I_{D2}=I_{D1}=K_1(V_{GS1}-V_{t1})^2=4m\times(5-3)^2=16mA$

$g_{m1}=2\sqrt{K_1I_{D1}}=2\sqrt{4m\times16m}=16mA/V$

$g_{m2}=2\sqrt{K_2I_{D2}}=2\sqrt{1m\times16m}=8mA/V$

$A_V=\dfrac{V_o}{V_i}=-g_{m1}\times(\dfrac{1}{g_{m2}}//R_L)=-16m\times(\dfrac{1}{8m}//10k)\fallingdotseq-1.98$

35. $I_D=\dfrac{V_{DD}-V_{DS}}{R_D+R_S}=\dfrac{15-7.5}{2k+1k}=2.5mA$

$V_{GS}=V_P\times(1-\sqrt{\dfrac{I_D}{I_{DSS}}})=-3\times(1-\sqrt{\dfrac{2.5m}{10m}})=-1.5V$

$V_G=V_S+V_{GS}=I_D\times R_S+V_{GS}=2.5m\times1k-1.5=1V$

$\dfrac{V_G}{V_{DD}}=\dfrac{R_G}{210k+R_G}$，即$\dfrac{1}{15}=\dfrac{R_G}{210k+R_G}$

$\therefore R_G=15k\Omega$

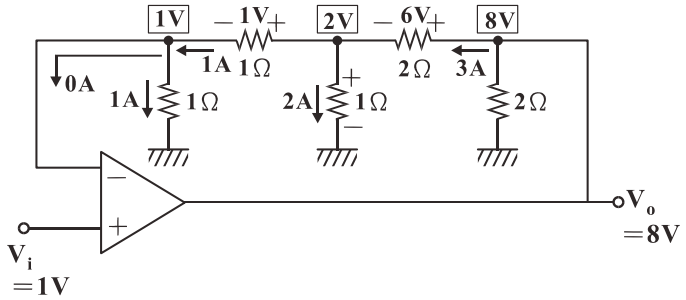
36. $g_m=\dfrac{2I_{DSS}}{|V_P|}\times(1-\dfrac{V_{GS}}{V_P})=\dfrac{2\times10m}{3}\times(1-\dfrac{-1.5}{-3})=3.3mA/V$

$A_V=\dfrac{-g_m(R_D//R_L)}{1+g_mR_S}=\dfrac{-3.3m\times(2k//10k)}{1+3.3m\times1k}=-1.28$

37. $Y=\overline{[(A\cdot B)+(C\cdot D)]\cdot E}=(\overline{A}+\overline{B})\cdot(\overline{C}+\overline{D})+\overline{E}$

38. 令 $R=1\Omega$，且 $V_i=1V$

$A_V=\dfrac{V_o}{V_i}=\dfrac{8V}{1V}=8$



39. $V_o=-[\dfrac{60k}{30k}\times(-3)+\dfrac{60k}{20k}\times(-2)+\dfrac{60k}{10k}\times2]+[(\dfrac{2}{20k}+\dfrac{1}{10k})\times(20k//10k//20k)]\times(1+\dfrac{60k}{30k//20k//10k})$

$=0+12=12V$

40. $V_U=15\times\dfrac{2k}{18k+2k}+1\times\dfrac{18k}{2k+18k}=2.4V$

$V_L=-15\times\dfrac{2k}{18k+2k}+1\times\dfrac{18k}{2k+18k}=-0.6V$

41. $V_R=0V$ 時：

$$V_U=\frac{2k}{18k+2k}\times 15=1.5V$$

$$V_L=\frac{2k}{18k+2k}\times(-15)=-1.5V$$

$\therefore V_i(t)=3\sin(100t)V$ ┬ $+V_{ip}=3V>1.5V$
　　└ $-V_{ip}=-3V<-1.5V$

$\therefore V_o$ 為方波

43. $\because V_{r(P-P)}=\frac{V_P}{2f_sR_LC}$　$\therefore C$ 值愈大，輸出漣波電壓 $V_{r(P-P)}$值愈小。

44. $$I_{Z(max)}=\frac{P_{Z(max)}}{V_Z}=\frac{150mW}{10V}=15mA$$

$$I_L=\frac{V_Z}{R_L}=\frac{10}{1k}=10mA$$

$$\begin{cases} I_{R(min)}=I_{Z(min)}+I_L=2m+10m=12mA \\ I_{R(max)}=I_{Z(max)}+I_L=15m+10m=25mA \end{cases}$$

$$\begin{cases} R_{(max)}=\frac{V_S-V_Z}{I_{R(min)}}=\frac{16-10}{12m}=500\Omega \\ R_{(min)}=\frac{V_S-V_Z}{I_{R(max)}}=\frac{16-10}{25m}=240\Omega \end{cases}$$

45. (1) $V_{EE}=V_{BE}+I_ER_E=0.7+1.3m\times 8k=11.1V$

(2) $$\alpha=\frac{\beta}{1+\beta}=\frac{199}{1+199}=0.995$$

$$r_e=\frac{V_T}{I_E}=\frac{26mV}{1.3mA}=20\Omega$$

$$A_V=\frac{V_o}{V_i}=\alpha\times\frac{R_C/\!/R_L}{r_e}=0.995\times\frac{6k/\!/6k}{20}=149.25$$

46. ENMOS 飽和區 ┬ $V_{GS}>V_t$
　　├ $V_{GD}<V_t$
　　└ $V_{DS}\geqq V_{GS}-V_t$

選項(C)：$V_{GS}=3V$，$V_{DS}=1.5V$，而 $V_t=2.5V$

$\therefore V_{GD}=V_{GS}-V_{DS}=3-1.5=1.5V$，而 $V_{GS}-V_t=3-2.5=0.5V$

$\therefore$ ┬ $V_{GS}>V_t(3V>2.5V)$
　　├ $V_{GD}<V_t(1.5V<2.5V)$
　　└ $V_{DS}>V_{GS}-V_t(1.5V>0.5V)$

47. $I_D = \dfrac{V_{DD} - V_D}{R_D} = \dfrac{12-6}{1.2k} = 5mA$

$K = \dfrac{I_D}{(V_{GS} - V_t)^2} = \dfrac{5m}{(2.5-2)^2} = 20mA/V^2$

48. $f_H = \dfrac{1}{2\pi R_A C_A} = \dfrac{0.1592}{0.5k \times 0.01\mu} = 31.84kHz$

$f_L = \dfrac{1}{2\pi R_B C_B} = \dfrac{0.1592}{1k \times 0.05\mu} = 3.184kHz$

$BW = f_H - f_L = 31.84k - 3.184k \fallingdotseq 28.66kHz$

49. $f_o = \dfrac{1}{2RC \ln(1 + \dfrac{2R_2}{R_1})} = \dfrac{1}{2 \times 50k \times 0.2\mu \times \ln(1 + \dfrac{2 \times 8.5k}{10k})} = 50Hz$

50. $f_o = \dfrac{1}{2\pi\sqrt{6}RC} = \dfrac{0.065}{10k \times 0.01\mu} = 650Hz$

$R_2 = 29 \times R_1 = 29 \times 20k = 580k\Omega$