

平成 13 年度 有明工業高等専門学校 (編入学試験)
電子情報工学科 (90 分) 解答

A1. (1) 全抵抗を R_0 とする .

$$R_0 = 10 + \frac{1}{\frac{1}{20} + \frac{1}{30}} = 22$$

$$I = \frac{V}{R} = \frac{220}{22} = 10$$

$$P = I^2 R = 10^2 \times 10 = 1000 \text{ [W]}$$

(2) 全抵抗を R_0 , 全電流を I_0 とする .

$$R_0 = \frac{1}{\frac{1}{10} + \frac{1}{40}} + \frac{1}{\frac{1}{20} + \frac{1}{30}} = 20$$

$$I_0 = \frac{V}{R_0} = \frac{220}{20} = 11$$

$$I = \frac{40}{40 + 10} I_0 = \frac{4}{5} \times 11 = \frac{44}{5}$$

$$P = I^2 R = \left(\frac{44}{5} \right)^2 \times 10 = 774.4 \text{ [W]}$$

A2. (1)

$$Q = C_1 V_1 = 100 \times 10^{-6} \times 80 = 8 \times 10^{-3} \text{ [C]}$$

$$C_2 = \frac{Q}{V_2} = \frac{8 \times 10^{-3}}{20} = 400 \times 10^{-6} = 400 \text{ [\mu F]}$$

(2)

$$Q = C_1 V = 100 \times 10^{-6} \times 100 = 0.01 \text{ [C]}$$

$$V_3 = \frac{Q}{C} = \frac{0.01}{(100 + 400) \times 10^{-6}} = 20 \text{ [V]}$$

A3. (1) ① $10 - 5 = 1 \cdot I_1 + 3(I_1 - I_2)$

② $5 = 3(I_2 - I_1) + 3I_2$

(2) ①, ②より $I_1 = 3 \text{ [A]}$, $I_2 = \frac{7}{3} \text{ [A]}$ であるから

$$V_3 = I_2 R_3 = \frac{7}{3} \times 3 = 7 \text{ [V]}$$

A4. (1) $L = \frac{\mu A N^2}{\ell} \text{ [H]}$

$$\begin{aligned}
 (2) \quad L_1 &= \frac{N_1^2}{R_m} = \frac{N_1^2}{\frac{\ell}{\mu A}} = \frac{\mu A N_1^2}{\ell} \\
 &= \frac{4\pi \times 10^{-7} \times 100 \times 4 \times 10^{-4} \times 2000^2}{0.4} \doteq 5.03 \text{ [H]}
 \end{aligned}$$

$$(3) \quad L_2 = L_1 \times \left(\frac{4000}{2000}\right)^2 = 4L_1 \quad \text{より} \quad 4 \text{ 倍} .$$

$$\begin{aligned}
 (4) \quad M &= k\sqrt{L_1 \cdot L_2} \\
 k &= 1 \text{ として考えることができる場合は } M = \sqrt{L_1 \cdot L_2}
 \end{aligned}$$

A5. (1) DC: $V = 100 \text{ [V]}$ のとき , $I = 2.5 \text{ [A]}$ なので

$$R = \frac{V}{I} = \frac{100}{2.5} = 40 \text{ } [\Omega]$$

AC: $V = 100 \text{ [V]}$ のとき , $I = 2 \text{ [A]}$ なので

$$Z = \frac{V}{I} = \frac{100}{2} = 50 \text{ } [\Omega]$$

よって , 力率は

$$\cos \theta = \frac{R}{Z} = \frac{40}{50} = 0.8$$

$$(2) \quad P = VI \cos \theta = 100 \times 2 \times 0.8 = 160 \text{ [W]}$$

B1. (1) f, a

(2) e, n

(3) m, c

(4) g

(5) i, j, l

B2. 1.

$$3 = 120 \times 10^3 \times I_B + 0.7 \quad \text{より} \quad I_B = 19.2 \text{ } [\mu\text{A}]$$

2. $h_{FE} = I_C / I_B$ より

$$I_C = h_{FE} I_B = 200 \times 19.2 \times 10^{-6} \doteq 3.83 \times 10^{-3} = 3.83 \text{ [mA]}$$

3.

$$9 = V_{CE} + 10^3 \times 3.83 \times 10^{-3} \quad \text{より} \quad V_{CE} = 5.17 \text{ [V]}$$

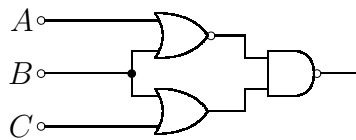
B3. 1. $\begin{cases} V_1 = R_1 I_1 \\ V_2 = -R_2 I_1 \end{cases} \quad \text{より} \quad V_2 = -\frac{R_2}{R_1} V_1$

2. $A_0 = -\frac{R_2}{R_1}$

B4. 1.

$$\begin{aligned} F &= \overline{\overline{A \cdot (\overline{A \cdot B})} + \overline{B \cdot (\overline{A \cdot B})}} \\ &= \overline{\overline{A \cdot (\overline{A \cdot B})} \cdot \overline{B \cdot (\overline{A \cdot B})}} \end{aligned}$$

2.



B5. 出力の状態は $Q = 1$, $\overline{Q} = 0$ となる .

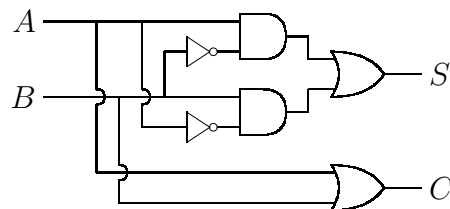
C1. ①オ ②ト ③ソ ④シ ⑤イ ⑥コ ⑦ウ ⑧ツ ⑨ア ⑩ク ⑪エ

C2. (1)

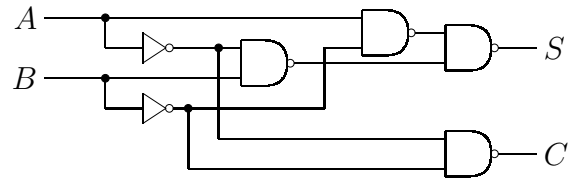
$$\begin{aligned} S &= \overline{A} \cdot B + A \cdot \overline{B} \\ &= \overline{(\overline{A \cdot B}) + (A \cdot \overline{B})} \\ &= \overline{(\overline{A \cdot B})} \cdot \overline{(A \cdot \overline{B})} \end{aligned}$$

$$\begin{aligned} C &= A \cdot B \\ &= \overline{\overline{A \cdot B}} \end{aligned}$$

(2)



(3)



C3. (1) 123, CD

(2) 11100, 480, 15000, 1010101

(3) E9, 7F, E3, 64

C4. 使用言語：BASIC

```

100  n=10
110  dim p(n)
120  for i=1 to 10:input p(i):print p(i)
130  next i
140  for i=1 to 9
150      for k=i+1 to 10
160          if p(i) >=p(k) then 200
170              d=p(i)
180              p(i)=p(k)
190              p(k)=d
200      next k
210  next i
220  for i=1 to 10
230      print using" # # # # #";p(i)
240  next i
250  end
  
```