

ΑΠΑΝΤΗΣΕΙΣ ΗΛΕΚΤΡΟΛΟΓΙΑΣ 27/5/15

ΟΜΑΔΑ ΠΡΩΤΗ

A 1.1. β, A 1.2. α, A 1.3. β, A 1.4. γ

A2. $(x + y) \cdot (x + \bar{y}) = x + y \cdot \bar{y} = x + 0 = x$

x	y	x+y	$\bar{y}$	$x + \bar{y}$	$(x + y) \cdot (x + \bar{y})$
0	0	0	1	1	0
0	1	1	0	0	0
1	0	1	1	1	1
1	1	1	0	1	1

A3. Σε σειρά: $E_{ολ} = 2E$, $r_{ολ} = 2r$

$$I_1 = \frac{E_{ολ}}{R + r_{ολ}} = \frac{2E}{R + 2r} \quad (1)$$

Παράλληλα: $E_{ολ} = E$, $r_{ολ} = \frac{r}{2}$

$$I_2 = \frac{E_{ολ}}{R + r_{ολ}} = \frac{E}{R + \frac{r}{2}} \quad (2)$$

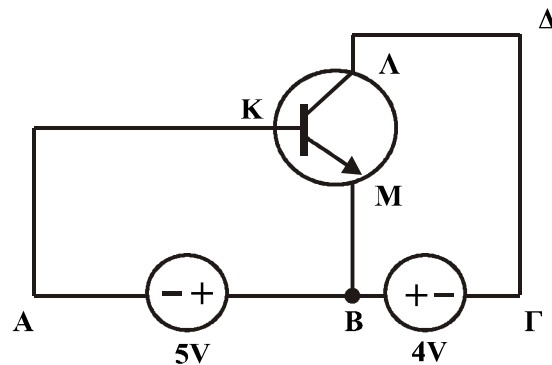
$$\frac{I_1}{I_2} = \frac{7}{4} \quad \text{άρα από σχέσεις (1) και (2) προκύπτει}$$

$$\frac{7}{4} = \frac{2E \left(R + \frac{r}{2} \right)}{E(R + 2r)} \quad \text{άρα} \quad \frac{7}{4} = \frac{2R + r}{R + 2r}$$

$$7R + 14r = 8R + 4r$$

$$10r = R \quad \frac{R}{r} = 10$$

A4.



- α) Εφαρμόζουμε τον 2^ο νόμο του Kirchhoff στον βρόγχο KABΓΔΛ:
 $V_K + 5V - 4V - V_\Lambda = 0$ άρα $V_K - V_\Lambda = -1V$ $V_{K\Lambda} = -1V$

Όμοια στον βρόγχο KABM:

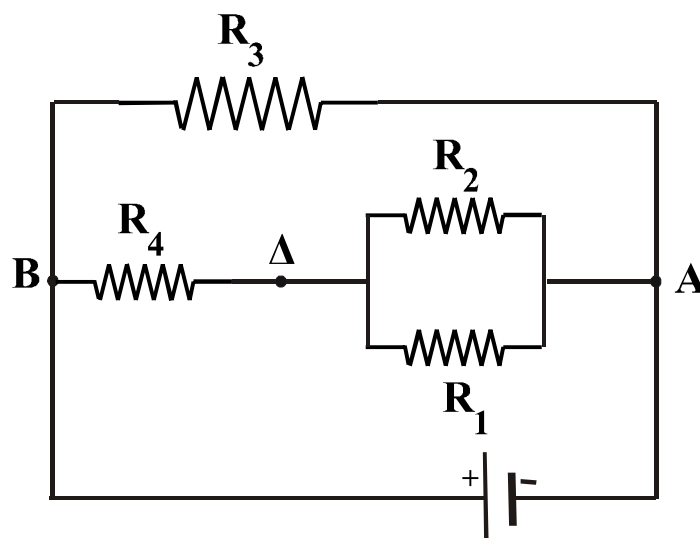
$$V_K + 5V - V_M = 0 \text{ άρα } V_K - V_M = -5V \quad V_{KM} = -5V$$

- β) Το τρανζίστορ λειτουργεί στην περιοχή αποκοπής και ισοδυναμεί με ανοιχτό διακόπτη γιατί οι επαφές pn έχουν πολωθεί ανάστροφα.

- A5. $(57)_8 = 5 \cdot 8^1 + 7 \cdot 8^0 = 40 + 7 = 47$
 Στο δυαδικό ο αριθμός είναι $(101111)_2$
 $1 \cdot 2^5 + 0 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 =$
 $= 32 + 0 + 8 + 4 + 2 + 1 = 47$
 Στο δεκαεξαδικό: $(2F)_{16}$
 $2 \cdot 16^1 + 15 \cdot 16^0 = 32 + 15 = 47$

ΘΕΜΑ Β

- B1 α) Το ισοδύναμο κύκλωμα είναι:



$$\frac{1}{R_{1,2}} = \frac{1}{R_1} + \frac{1}{R_2} \quad \text{άρα} \quad \frac{1}{R_{1,2}} = \frac{1}{3} + \frac{1}{6}$$

$$R_{1,2}=2\ \Omega$$

$$R_{1,2,4} = R_{1,2} + R_4 \quad \text{άρα} \quad R_{1,2,4} = 6\Omega$$

$$\frac{1}{R_{ολ.}} = \frac{1}{R_{1,2,4}} + \frac{1}{R_3} = \frac{1}{6} + \frac{1}{3} \quad \text{άρα} \quad R_{ολ.} = 2\Omega.$$

$$\beta) \quad I_{ολ.} = \frac{E}{R_{ολ.}} \quad I_{ολ.} = 18A$$

$$I_{1,2,4} = \frac{E}{R_{1,2,4}} \quad I_{1,2,4} = 6A \quad \text{όμως } I_{1,2,4} = I_{1,2} = 6A$$

$$V_{1,2} = I_{1,2} \cdot R_{1,2} \quad \text{άρα} \quad V_{1,2} = 12V = V_2 = V_{A\Delta}$$

$$I_2 = \frac{V_2}{R_2} \quad I_2 = 2A$$

$$P_2 = V_2 \cdot I_2 \quad P_2 = 24\ W$$

$$\gamma) \quad V_{\Gamma} = V_A \quad \text{άρα} \quad V_{B\Gamma} = V_{BA}$$

$$V_B - E - V_A = 0 \quad V_{BA} = E \quad \text{άρα } V_{BA} = 36V.$$

$$\mathbf{B2} \quad A_P \text{ (dB)} = 90 \text{ dB} \quad \text{άρα}$$

$$\alpha) \quad 90 = 10 \log \frac{P_{\varepsilon_{\zeta}^{\varepsilon}}}{P_{\varepsilon I \sigma}} \Rightarrow 9 = \log \frac{P_{\varepsilon_{\zeta}^{\varepsilon}}}{P_{\varepsilon I \sigma}}$$

$$A_P = \frac{P_{\varepsilon_{\zeta}^{\varepsilon}}}{P_{\varepsilon I \sigma}} = 10^9$$

$$A_I \text{ (dB)} = 100 \text{ dB} \quad \text{άρα}$$

$$100 = 20 \log \frac{I_{\varepsilon_{\zeta}^{\varepsilon}}}{I_{\varepsilon I \sigma}} \Rightarrow 5 = \log \frac{I_{\varepsilon_{\zeta}^{\varepsilon}}}{I_{\varepsilon I \sigma}}$$

$$\text{Οπότε } A_I = \frac{I_{\varepsilon_{\zeta}^{\varepsilon}}}{I_{\varepsilon I \sigma}} = 10^5$$

$$\frac{P_{\varepsilon_{\zeta}^{\varepsilon}}}{P_{\varepsilon I \sigma}} = \frac{V_{\varepsilon_{\zeta}^{\varepsilon}} \cdot I_{\varepsilon_{\zeta}^{\varepsilon}}}{V_{\varepsilon I \sigma} \cdot I_{\varepsilon I \sigma}} \quad \text{άρα} \quad \frac{V_{\varepsilon_{\zeta}^{\varepsilon}}}{V_{\varepsilon I \sigma}} = \frac{10^9}{10^5} = 10^4$$

$$A_v \text{ (dB)} = 20 \cdot \log \frac{V_{\varepsilon_{\zeta}^{\varepsilon}}}{V_{\varepsilon I \sigma}} = 20 \cdot \log 10^4 = 80 \text{ dB}.$$

$$\beta) \quad \frac{P_{\varepsilon_{\sigma}^{\varepsilon}}}{P_{\varepsilon_{1\sigma}}} = \frac{I_{\varepsilon_{\sigma}^{\varepsilon}}^2 \cdot R_{\varepsilon_{\sigma}^{\varepsilon}}}{I_{\varepsilon_{1\sigma}}^2 \cdot R_{\varepsilon_{1\sigma}}} \quad \acute{\alpha}\rho\alpha$$

$$10^9 = (10^5)^2 \cdot \frac{R_{\varepsilon_{\sigma}^{\varepsilon}}}{R_{\varepsilon_{1\sigma}}} \Rightarrow \frac{R_{\varepsilon_{\sigma}^{\varepsilon}}}{R_{\varepsilon_{1\sigma}}} = \frac{1}{10} \Rightarrow R_{\varepsilon_{\sigma}^{\varepsilon}} = 32 \Omega.$$

B3.

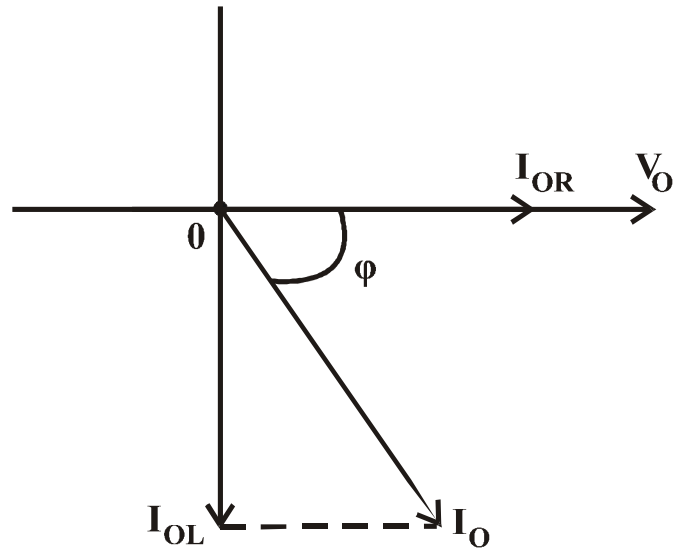
$$\alpha) \quad I_{OR} = \frac{V_{OR}}{R} = \frac{V_O}{R} = \frac{120\sqrt{3}}{40\sqrt{3}} = 3A$$

$$I_{OL} = \frac{V_{OL}}{L\omega} = \frac{120\sqrt{3}}{0,04 \cdot 1000} = 3\sqrt{3}A$$

$$I_R = I_{OR} \eta \mu 1000t = 3\eta \mu 1000t$$

$$I_L = I_{OL} \eta \mu \left(1000t - \frac{\pi}{2}\right) = 3\sqrt{3}\eta \mu \left(1000t - \frac{\pi}{2}\right)$$

β)



$$\gamma) \quad I_O = \sqrt{I_{OR}^2 + I_{OL}^2} = \sqrt{3^2 + (3\sqrt{3})^2} = 6A$$

$$I_O = \frac{V_O}{Z} \Rightarrow Z = \frac{V_O}{I_O} = \frac{120\sqrt{3}}{6} = 20\sqrt{3}\Omega$$

$$\delta) \quad \sigma_{\text{υν}\phi} = \frac{I_{OR}}{I_O} = \frac{3}{6} = \frac{1}{2} \quad \acute{\alpha}\rho\alpha \quad \phi = \frac{\pi}{3}$$

$$I = I_O \eta \mu \left(1000t - \frac{\pi}{3}\right) = 6\eta \mu \left(1000t - \frac{\pi}{3}\right)$$

$$\varepsilon) \quad P = \frac{1}{2} V_O I_O \sigma_{\text{υν}\phi} = \frac{120\sqrt{3} \cdot 6}{2} \cdot \frac{1}{2} = 180\sqrt{3} \text{ W}$$