

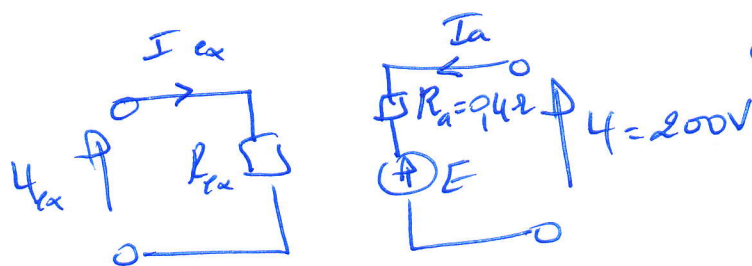
(I)

كشرح المسكان الثاني معاشن كمر با لول
المسك الثاني اسناد العليم الثاني

السؤال 1

1- حرد ذ اكرض مسقل / $U = 200V$ / $R_a = 0.4\Omega$
 $E = 180V$ / $n = 1500 + n/min$ لدينا

الخلافة بين E و n
 لدينا المسك الثاني



و لدينا 1
 $E = k\Phi\Omega$ ($\Phi = \text{cte}$ و $\Omega = 2\pi n$)

$\Rightarrow E = k \cdot 2\pi n$

$\Rightarrow \boxed{E = kn}$ ($k = k\Phi \cdot 2\pi$)

$\Rightarrow \boxed{k = \frac{E}{n}}$

AN: $k = \frac{180}{1500} = 0.12$

$\boxed{E = 0.12n}$

(2) E و I و n
 لدينا

$U = E + R_a I$

$\Rightarrow \boxed{I = \frac{U - E}{R_a} = \frac{U}{R_a} - \frac{E}{R_a}}$

AN:

$I = \frac{200}{0.4} - \frac{E}{0.4} \Rightarrow \boxed{I = 500 - \frac{E}{0.4}}$

(II)

س I W k n T_{em} ٢, ٣, ٤ / 3

$$T_{em} = \frac{P_{em}}{\omega}$$

$$(\omega = 2\pi n) \quad \text{: ليد}$$

$$(P_{em} = EI)$$

س ٥ : ١

$$T_{em} = \frac{E \cdot I}{\frac{2\pi n}{60}}$$

AN

$$T_{em} = \frac{180 \times 60}{2\pi \cdot 1500} \times I$$

$$\Rightarrow \boxed{T_{em} = 1,14 I}$$

$$\text{س } T_{em} = 570 - 0,342 n$$

$$\text{' } 0,12 \text{ n} \text{ - (4)}$$

س ليد

$$T_{em} = 1,14 I$$

$$I = 500 - \frac{E}{0,14}$$

س ليد

$$I = 500 - \frac{0,12 n}{0,14}$$

$$E = 0,12 n \text{ س } 20$$

س ٥ : ١

$$T_{em} = 1,14 \left[500 - \frac{0,12 n}{0,14} \right]$$

س ليد

$$\Rightarrow \boxed{T_{em} = 570 - 0,342 n}$$

$T_4 = T_m$ ستجری نلوا P_c - (5)

Diagram illustrating the relationship between P_a , P_m , and P_4 across a boundary. The diagram shows a horizontal line with a break in the middle. Above the line, P_a is on the left, P_m is in the middle, and P_4 is on the right. Below the line, P_j is on the left and P_{∞} is on the right.

$$T_{em} = \frac{P_{em}}{\omega} = \frac{P_4}{\omega} = T_4 \quad \text{is valid}$$

۱۶۰۱

المحرك بدون حواء $T_4 = 0 \text{ N.m}$

$$T_{in} = 570 - 0.342n = 0 \quad \text{Find the Limiting Temp}$$

$$\Rightarrow n = 1667 \text{ Tr/min}$$

$\sin \omega x \sim Tv$

نوع ۱: Tr : شعری، سناسی، لایع "n"

$$T_r = Kn \Rightarrow K = \frac{T_r}{n}$$

(N)

$$\underline{AN} \quad k = \frac{d\omega}{1000} = 0,02$$

$$\boxed{k = 0,02}$$

جس

$$\boxed{T_r = 0,02n}$$

$$T_4 = T_r$$

و لنسا في السخيل الحادي

$$T_4 \leq T_{em}$$

(Pc=0)

و لنسا

و لنسا

$$\boxed{T_{em} \leq T_r}$$

بالتالي

$$570 - 0,342n = 0,02n$$

$$\Rightarrow n = \frac{570}{0,02 + 0,342}$$

$$\Rightarrow \boxed{n = 1575 \text{ tr/min}}$$

(b) لنسا I₂ و P₄

$$I = 500 - \frac{0,12n}{0,4} \quad (n = 1575 \text{ tr/min}) \text{ لنسا } \&$$

$$\underline{AN} \quad I = 500 - \frac{0,12 \cdot 1575}{0,4} \Rightarrow \boxed{I = 27,5 \text{ A}}$$

$$P_4 = P_{em} \quad (P_c = 0) \quad \text{لنسا } \&$$

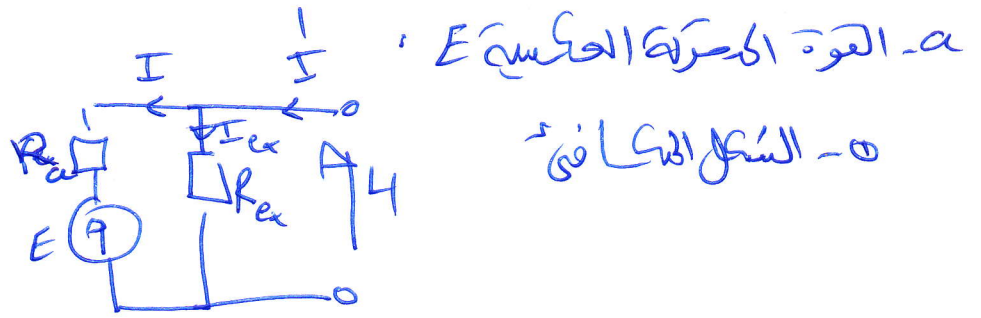
$$P_{em} = E \cdot I = P_4 \quad (E = 0,12 \text{ V})$$

$$\boxed{P_4 = 0,12 \cdot n \cdot I}$$

$$\underline{AN} \quad P_4 = 0,12 \cdot 1575 \cdot 27,5 \Rightarrow \boxed{P_4 = 5198 \text{ W}}$$

(V)

التحريك



$$4 = RI + E$$

لدينا :

$$\Rightarrow E = 4 - RI$$

AN:

$$E = 220 - 0,2 \times 75$$

$$E = 205 \text{ V}$$

b - في سلك المقاومة

$$P_a = 4 \cdot I'$$

لدينا :

$$I' = I + I_{ex}$$

و

$$P_a = 4 (I + I_{ex})$$

و

$$I = 75 \text{ A} \quad I_{ex} = ?$$

ولدينا :

$$4 = R_{ex} \cdot I_{ex} \Rightarrow I_{ex} = \frac{4}{R_{ex}}$$

نضع

$$P_a = 4 \left(I + \frac{4}{R_{ex}} \right)$$

و

AN: $P_a = 220 \left(\frac{220}{110} + 75 \right)$

$$\Rightarrow P_a = 16,94 \text{ kW}$$

(VI)

1. الموتور الكهربائي - C

$$P_a = P_u + \sum P_{\text{pertes}} \quad \text{1. قيد}$$

$$\sum P_{\text{pertes}} = \underbrace{P_{j(cex)}}_{?} + \underbrace{P_{j(csr)}}_{?} + P_c \quad \text{1.6 قيد}$$

$$* P_{j(cex)} = R_{ca} I_{ca}^2 = R_{ca} \left(\frac{4}{R_{ca}} \right)^2 \quad \text{1. قيد}$$

AN

$$P_{j(cex)} = 160 \left(\frac{220}{160} \right)^2$$
$$\Rightarrow P_{j(cex)} = 440 \text{ W}$$

$$* P_{j(csr)} = R_a I_a^2$$

AN

$$P_{j(csr)} = 0,2 (75)^2$$
$$\Rightarrow P_{j(csr)} = 1125 \text{ W}$$

$$P_u = P_a - \sum P_{\text{pertes}}$$

$$\Rightarrow P_u = P_a - (P_{j(cex)} + P_{j(csr)} + P_c)$$

AN

$$P_u = 16940 - (440 + 1125 + 700)$$
$$P_u = 14675 \text{ W}$$

d. المردود والعزم الميكانيكي

$$\eta = \frac{P_u}{P_a} \times 100$$

AN

$$\eta = \frac{14675}{16940} \times 100$$
$$\eta = 86,62 \%$$

(VII)

* T_4 :

$$P_u = T_4 \cdot \Omega \Rightarrow \boxed{T_4 = \frac{P_4}{\Omega}} \quad \text{حيث}$$

$$\boxed{T_4 = \frac{60 P_4}{2\pi n}}$$

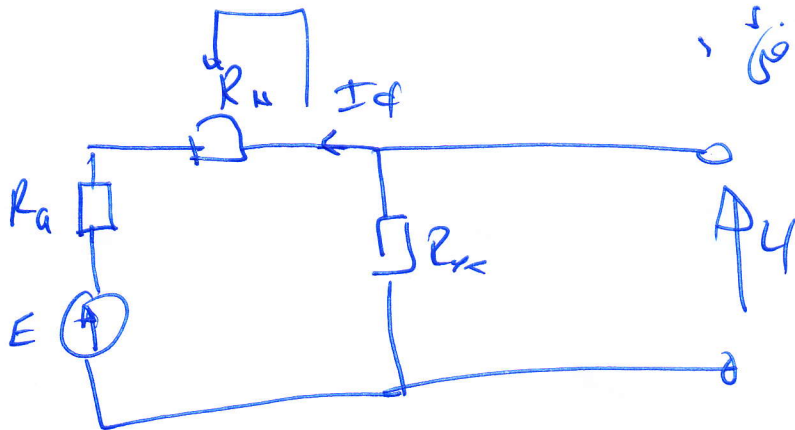
الحل

$$T_4 = \frac{14675 \times 60}{2\pi \times 1500}$$

$$\boxed{T_4 = 93,42 \text{ N.m}}$$

6- مقاومة بداية التسخين $\rightarrow I_d = 160 \text{ A}$

نرسم الدارة كما في:



$E = 0 \text{ V}$ — $n = 0 \text{ T/min}$ بداية التسخين

حيث

$$U = (R_a + R_{st}) I_d$$

$$\Rightarrow \boxed{R_{st} = \frac{U - R_a I_d}{I_d} = \frac{U}{I_d} - R_a}$$

الحل

$$R_{st} = \frac{2400}{160} - 0,2$$

$$\boxed{R_{st} = 1,175 \Omega}$$

VIII

3- تحديد سرعة الدوران :

a- حساب n في أجل $I_a = 45A$:

نبدأ :

$$4 = R_a I_a' + E'$$

$$\Rightarrow E' = 4 - R_a I_a'$$

AN :

$$E' = 220 - (0,2 \times 45)$$

$$\Rightarrow E' = 211 V$$

$$E = K \underbrace{\Phi}_{cst} \underbrace{\Omega}_{cst} = K \underbrace{\Phi}_{cst} \underbrace{2\pi n}_{cst}$$

و لدينا :

$$\Rightarrow E = K n$$

$$E' = K n'$$

و لدينا :

و لدينا :

$$\frac{E}{E'} = \frac{n}{n'} \Rightarrow n' = \frac{E}{E'} \cdot n$$

AN :

$$n' = \frac{211}{220} \times 1500$$

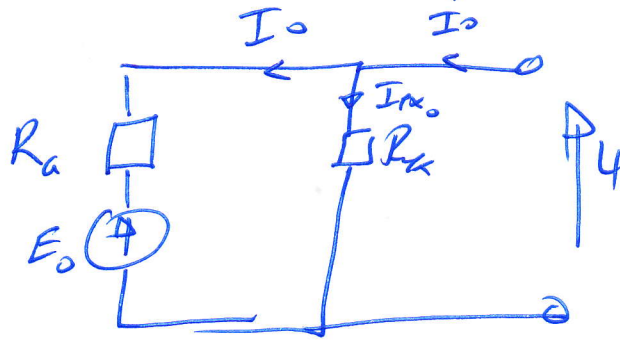
$$n' = 1544 \text{ Tr/min}$$

IX

ب- سرعة الدوران ب، و، تحويل:

$$P_{j(c)} \approx 0$$

$$P_c \gg P_{j(c)}$$



الرمح المكافئ:

$$P_a = P_c + P_{j(c)} + P_{j(x)} + \frac{P}{4}$$

$$P_{j(x)} = R_x I_{0(x)}^2$$

$$\Rightarrow P_{j(x)} = R_x \left(\frac{4}{R_x} \right)^2$$

$$\underline{AN} \quad P_{j(x)} = 440 \text{ W}$$

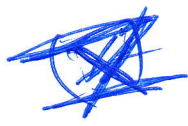
$$P_{a_0} = 440 + 700 = 1140 \text{ W}$$

$$P_{a_0} = 4 \cdot I_0 = 4 [I_0 + I_{0(x)}]$$

$$\Rightarrow I_0 = \frac{P_{a_0}}{4} - I_{0(x)} = \frac{P_{a_0}}{4} - \frac{4}{R_x}$$

$$\underline{AN} \quad I_0 = \frac{1140}{4} - \frac{220}{110}$$

$$\Rightarrow I_0 = 3.18 \text{ A}$$



و نعلیم *
1

$$E_0 = 4 - R_a I_0$$

ان

$$E_0 = 220 - (0,2 \times 3,18)$$

$$E_0 = 219,36 \text{ V}$$

$$E_0 = K n_0 \quad \text{و} \quad E' = K n'$$

$$\frac{E_0}{E'} = \frac{n_0}{n'} \Rightarrow n_0 = \frac{E_0}{E'} n'$$

ان

$$n_0 = 1605 \text{ tr/min}$$

Fin