

Electronics

Revision

Questions

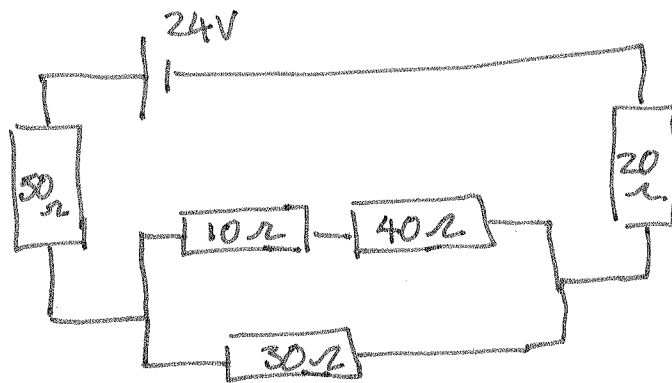
5/1/2011.

- BEng Eng Apps Revision.

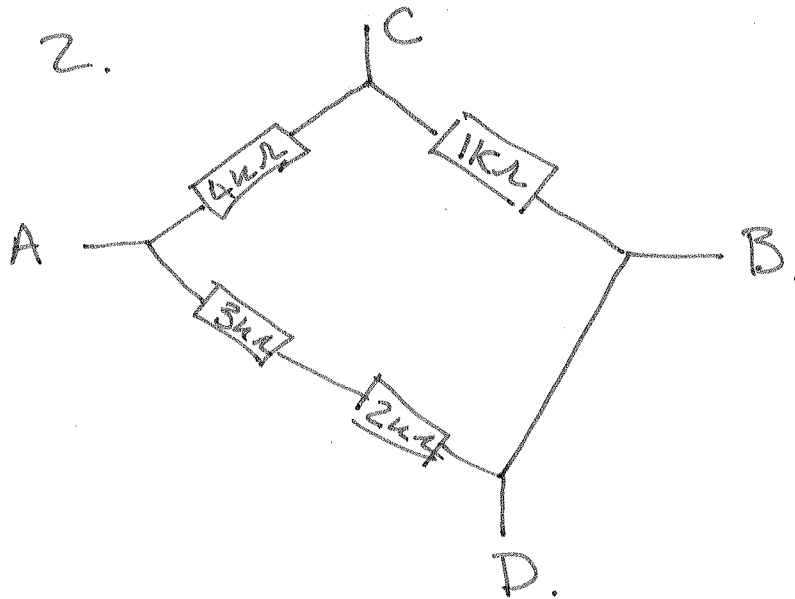
- F. Electronics Revision.

Question 1

- Calculate the total resistance
- Calculate the current I_T .
- Calculate the power dissipated by the $20\ \Omega$ resistor
- what would the total power dissipated by this circuit be?



Question 2.



- Calculate R_{AB} .
- Calculate R_{CD} .

Q1 a)
$$R_T = 50 + 20 + \frac{1}{\frac{1}{30} + \frac{1}{10+40}}$$

$$= 70 + \frac{1}{\frac{1}{30} + \frac{1}{50}}$$

$$= \underline{\underline{88.75 \Omega.}}$$

b) $V = I_T R_T$

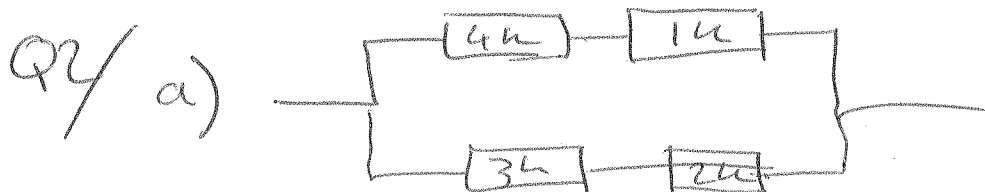
$$I_T = \frac{V}{R_T} = \frac{24}{88.75} = 0.27 \text{ A.}$$

c) $P = IV$

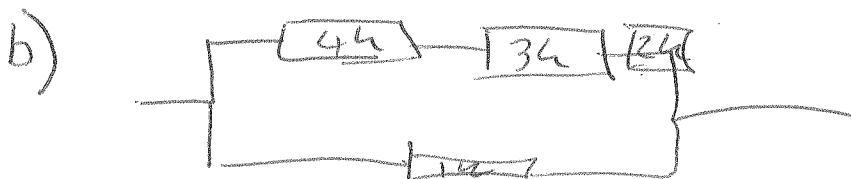
$$= \cancel{0.27} I^2 R = 0.27^2 \times 20 = 1.458 \text{ W.}$$

d) $P = I^2 R = 0.27^2 \times 88.75 \Omega.$

$$= 6.47 \text{ W.}$$

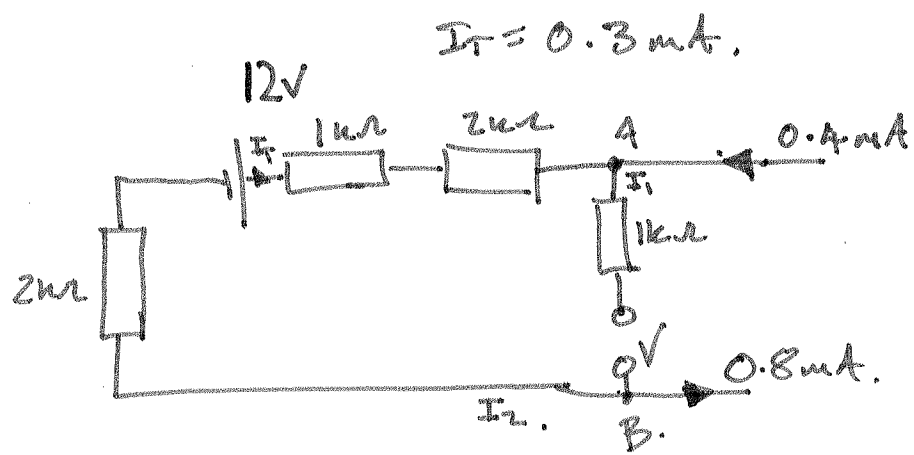


$$R_{AD} = \frac{1}{\frac{1}{4+1} + \frac{1}{3+2}} = \frac{1}{\frac{1}{5} + \frac{1}{5}} = 2.5 \Omega.$$



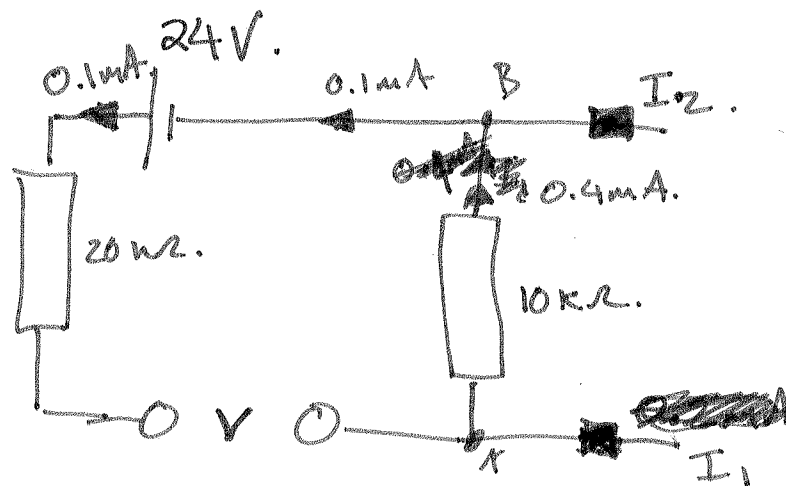
$$R_{CD} = \frac{1}{\frac{1}{1} + \frac{1}{4+3+2}} = \frac{1}{1 + \frac{1}{9}} = 0.9 \Omega$$

Question 3.



- Calculate current I_1
- Calculate current I_2
- Calculate magnitude of unknown voltage V ,
- Draw a battery cell to symbolise direction of unknown voltage.

Question 4.



- Calculate the unknown currents.
- Calculate the magnitude and direction of the unknown voltage.

Q3) K1 on node A

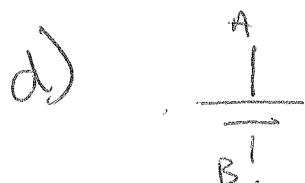
a) $0.3 + 0.4 + I_1 = 0$

b) KI on node B.

$$I_2 = 0.1 \text{ mA}$$

c) K2nd how. to loop.

$$V = -10.6 \text{ V}$$



Q4. a) h_1 @ node A.

$$0.1 + I_1 - 0.4 = 0$$

$$I_1 = 0.4 - 0.1 = \underline{\underline{0.3 \text{ mA}}}$$

$$0.4 - 0.1 + I_2 = 0$$

$$I_2 = 0.1 - 0.4 = \underline{\underline{-0.3 \text{ mA}}}$$

$$b) \quad 24 - (0.1 \times 20) + V - (10 \times 0.4) = 0 \quad \text{Arises from B.}$$

$$V = 4 + 2 - 24 = -18 \text{ V.} \quad \text{clockwise}$$

Question 5.

A ~~the~~ wire has a diameter of 0.16 mm and is made from a material with a resistivity of $2.65 \times 10^{-8} \Omega \cdot \text{m}$. Calculate the maximum length of the wire if the resistance is to be less than 0.5Ω .

Question 6.

Calculate the EMF of a battery if a terminal voltage of 10.8 V is measured when a current of 0.4 A is drawn through an internal resistance of 10Ω .

Question 7.

If a wire has a resistance of 0.1Ω at 0°C , a temperature coefficient of 4×10^{-3} and is measured to have a resistance of 0.76Ω in its working environment, calculate the temperature in this environment.

Q5/ $\phi = 0.16 \text{ mm}$
 $\rho = 2.65 \times 10^{-8} \text{ } \Omega \text{ m.}$
 $R_{\text{max}} = 0.5 \text{ } \Omega$

$$R = \frac{\rho l}{A}$$

$$l = ?$$

$$l = \frac{RA}{\rho} = \frac{0.5 \times \pi \times (0.16 \times 10^{-3})^2}{4 \times 2.65 \times 10^{-8}}$$

$$l = \underline{\underline{0.379 \text{ m.}}}$$

Q6/ $E - IR_{\text{int}} = V$

$$E = V + IR = 10.8 + (4 \times 10)$$

$$E = 10.8 + 4 = \underline{\underline{14.8 \text{ V.}}}$$

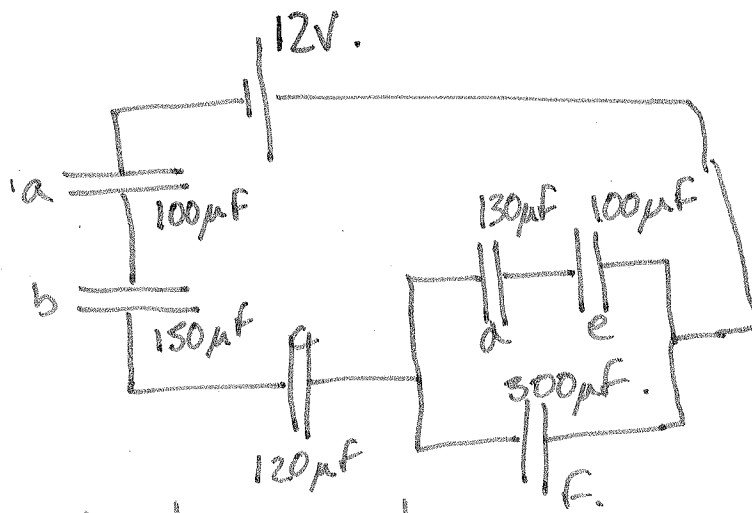
Q7/ $R_0 = 0.1 \text{ } \Omega$
 $\alpha = 4 \times 10^{-3} \text{ } ^\circ\text{C}^{-1}$

$$R_1 = 0.16 \text{ } \Omega$$

$$R_1 = R_0 + R_0 \alpha \Delta T$$

$$\Delta T = \frac{R_1 - R_0}{R_0 \alpha} = \frac{0.16 - 0.1}{0.1 \times 4 \times 10^{-3}} = \underline{\underline{150^\circ\text{C.}}}$$

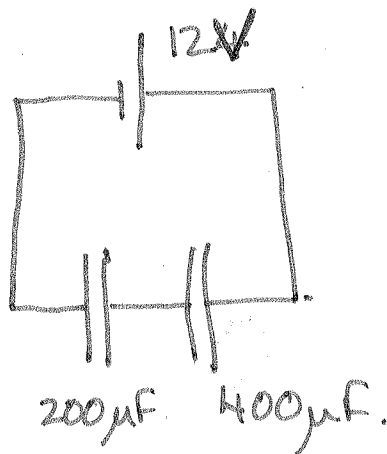
Question 8.



Calculate the total capacitance.

Question 9.

Calculate the total energy stored by the circuit below.



Question 10.

a). Explain what is meant by the term electromagnetic induction.

b) What is the advantage of 3 phase electricity in terms of an alternator output?

Question 8.

$$\text{Cable } C_{de} = \frac{1}{\frac{1}{130} + \frac{1}{100}} = 56.52 \mu\text{F.}$$

$$C_{def} = 56.52 + 300 \text{ ~~100~~ } = 356.52 \mu\text{F.}$$

$$C_{abco\text{ef}} = \frac{1}{\frac{1}{100} + \frac{1}{150} + \frac{1}{120} + \frac{1}{356.52}}$$

$$\underline{\underline{C_T = 35.96 \mu\text{F.}}}$$

Question 9.

$$C_T = \frac{1}{\frac{1}{200} + \frac{1}{400}} = 133.33 \mu\text{F.}$$

$$E = \frac{CV^2}{2} = \frac{133.33 \times 12^2}{2} = \underline{\underline{72 \text{ J.}}}$$

Question 10

a) Electromagnetic induction is where a ~~an~~ electrical current is induced in a conductor as it cuts through a magnetic field. eg A wire which passes through a magnetic flux field will have a ~~voltage~~ current induced and current direction will be independent on motion + field direction.

b) When a 3 phase output is rectified a smother output current would be obtained when compared with a like single phase output.

c) An alternating current is passed through a primary coil which produces an alternating magnetic flux. This magnetic flux cuts a secondary coil which is positioned close to but insulated from the primary coil. The flux change induces a current in the secondary coil which is proportional to the number of coils on the secondary.

c) Explain how a transformer steps up or steps down voltages.

Question 11.

a) ~~Explain what a data logger does.~~
Explain the purpose of a data logger and unit.

b) Strain gauges are often used ~~to measure~~ⁱⁿ ~~strain~~ conjunction ~~of~~ with data loggers to measure loads. How is force calculated from strain?

~~How~~ how do strain gauges work.

c) Explain how a standard linear position potentiometer works.

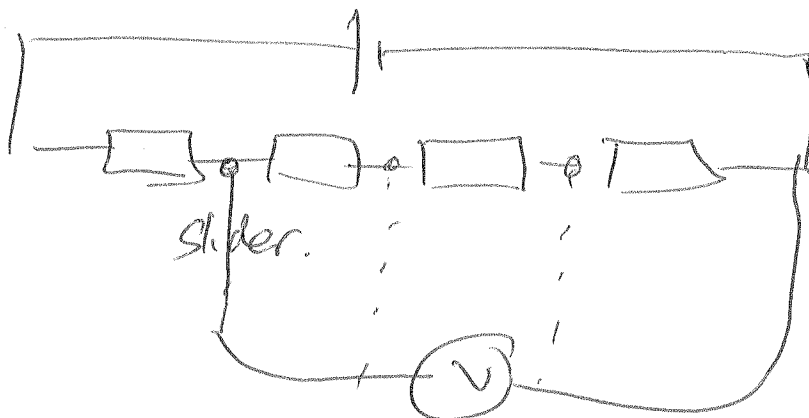
Question 11

a) A data logger gathers signals produced by sensors measuring physical variables, digitizes these signals, and stores them in memory for later analysis.

b) $E = \frac{\Delta L}{L}$ $E = \frac{\sigma}{E}$ $\sigma = \frac{F}{A}$

$$E = \frac{F}{AE} \quad \text{or} \quad F = \frac{EA}{E}$$

c) resistive track + slider



More resistive track $\rightarrow$ high resistance
less " " " $\rightarrow$ low "