UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2008/2009

NAMA MATA PELAJARAN	: TEKNOLOGI ELEKTRIK DAN ELEKTRONIK
KOD MATAPELAJARAN	: BEE 1803
KURSUS	: 1BDD
TARIKH PEPERIKSAAN	: APRIL/MEI 2009
JANGKAMASA	: 2 1/2 JAM
ARAHAN	: JAWAB EMPAT (4) SOALAN SAHAJA DARIPADA ENAM (6) SOALAN.

KERTAS SOALAN INI MENGANDUNGI (10) MUKA SURAT.

Q1 (a) (i) Give the definition of resistance and effect of the conductor length to its resistance.

(5 marks)

(ii) The relationship between current and voltage is known as Ohm's law. With the help of a graph, give a definition of Ohm's law and state the equation.

(3 marks)

(b) Referring to the circuit in Figure Q1(b), calculate:

(i) The current i when the switch is in position 1
(ii) The current i when the switch is in position 2

(4 marks)

(c) When the voltage across a resistor is 120 V, the current through it is 2.5 mA. Calculate its conductance.

(4 marks)

(d) Figure Q1(d) shows a resistor. Calculate the resistance and give the range value for this resistor.

(3 marks)

(e) A certain resistor has the following color code: violet, blue, red, silver. Determine the minimum current can be measured when a 20 V source is connected accross the resistor.

(6 marks)

Q2 (a) Define the terms below with the aid of appropriate diagrams and equations.

(i) Kirchhoff's Current law (KCL)
(ii) Kirchhoff's Voltage law (KVL)

(6 marks)

(b) Determine the Thevenin and Norton equivalent circuits from the circuit of Figure Q2(b) and calculate the:

(i) Thevenin equivalent resistance, R_{TH}
(ii) Thevenin voltage, V_{TH}
(iii) Norton equivalent resistance, R_N
(iv) Norton current, I_N
(v) Load current, i_L for each case

Assume R_3 is the load.
Given: $V_{S1} = V_{S2} = 450$ V, $R_1 = 7\ \Omega$, $R_2 = 5\ \Omega$, $R_3 = 10\ \Omega$, $R_4 = R5 = 1\ \Omega$

(19 marks)

Q3 (a) Three capacitors, C_1=5 μF, C_2=10 μF, and C_3=20 μF are placed in series with a 200 V source. Compute:

(i) The total capacitance
(ii) The charge on each capacitor
(iii) The total energy stored in the series combination
(iv) The voltage across 10 μF capacitor

(9 marks)

(b) Referring to the circuit in Figure Q3(b), given $i(t) = 4(2 - e^{-10t})\ mA$. If $i_2(0) = -1\ mA$, find the value:

(i) $i_1(0)$
(ii) $v(t)$, $v_1(t)$ *and* $v_2(t)$
(iii) $i_1(t)$ *and* $i_2(t)$

(16 marks)

Q4 (a) Construct a table that showing the binary, octal, hexadecimal and BCD code representations by referring the decimal numbers from 0 to 15.

(8 marks)

(b) Derive the expression for the output circuit, X of Figure Q4(b)(i) and construct a complete truth table. Then apply the waveforms of Figure Q4(b)(ii) to the respective circuit inputs of Figure Q4(b)(i) and draw the output waveform.

(10 marks)

(c) Simplify the expression given using K map method.

$$y = \overline{(\overline{C + D})} + \overline{A}\,C\,\overline{D} + A\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,C\,D + AC\,\overline{D}$$

(7 marks)

Q5 (a) Convert the following complex numbers to polar form by determining the magnitude and angle.

(i) $-12 - j18$

(ii) $-7 + j10$

(6 marks)

(b) Find the current $i_1(t)$ and $i_2(t)$ in the circuit in Figure Q5(b) by using mesh analysis method.

(19 marks)

Q6 (a) List and explain briefly three electromagnetic properties.

(6 marks)

(b) Explain the electromagnetic devices listed as follows.

(i) Solenoid

(ii) Speaker

(8 marks)

(c) Calculate the reluctance of a doughnut-shaped core made of low-carbon steel. The inner radius of the doughnut-shaped core is 1.75 cm and the outer radius of the doughnut-shaped core is 2.25 cm. Assume the permeability of low-carbon steel is 2×10^{-4} Wb/At•m.

(11 marks)

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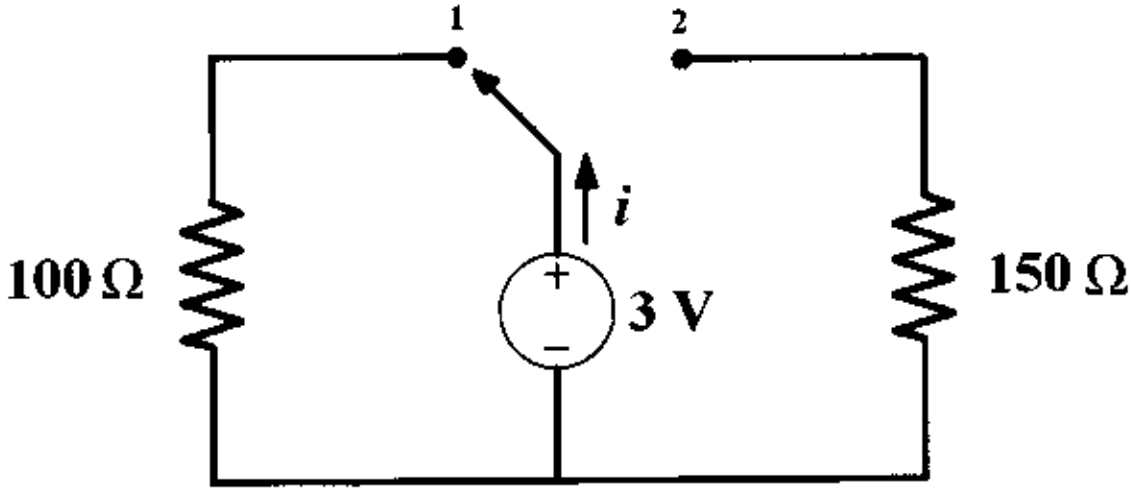

FIGURE Q1(b)

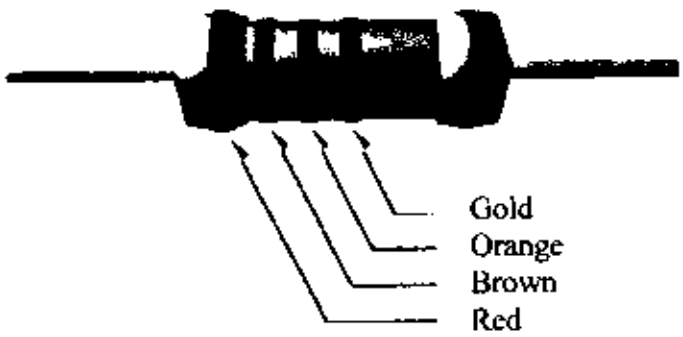

FIGURE Q1(d)

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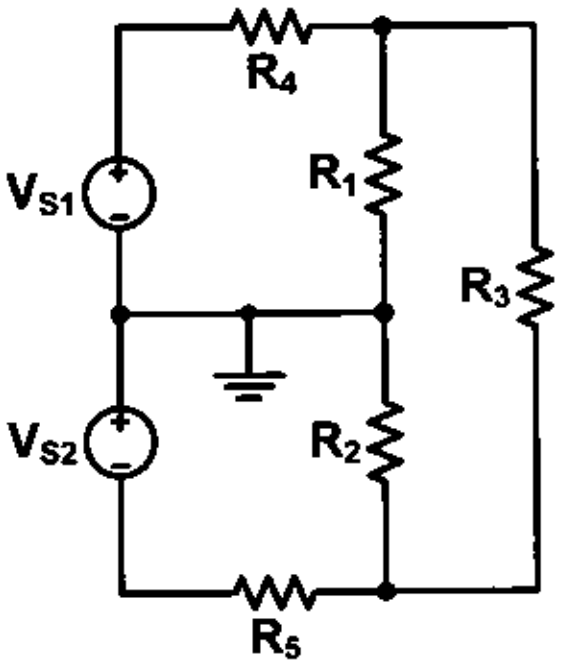

FIGURE Q2(b)

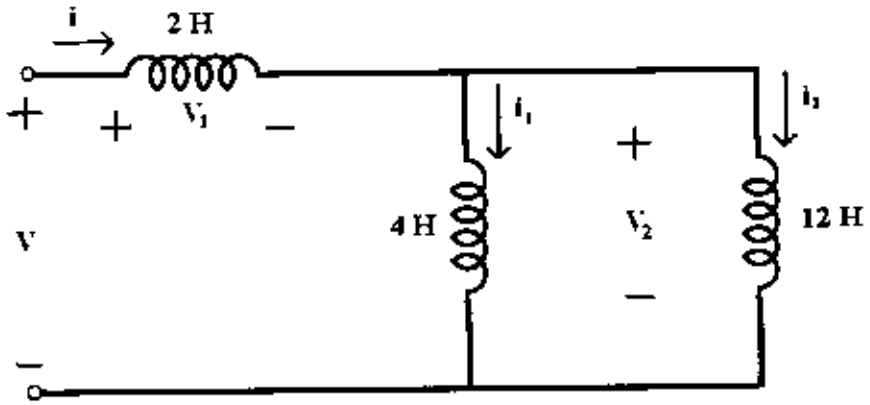

FIGURE Q3(b)

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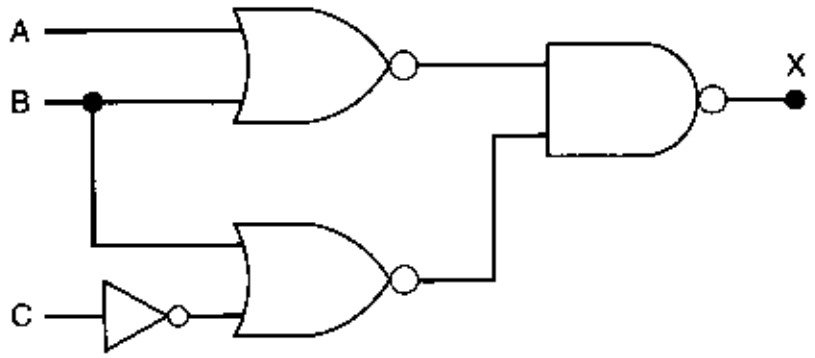

FIGURE Q4(b)(i)

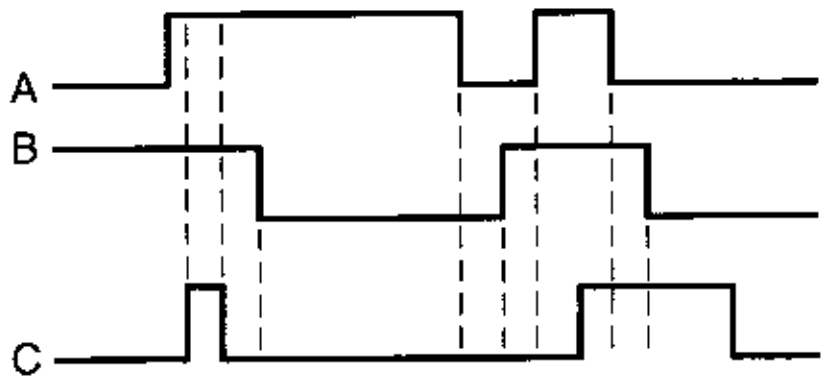

FIGURE Q4(b)(ii)

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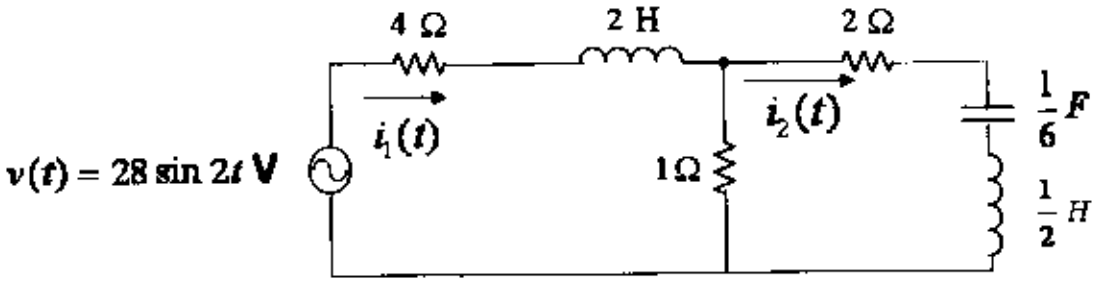

FIGURE Q5(b)

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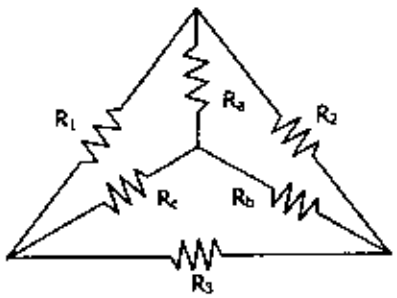
LIST OF FORMULAS

1. Delta-Wye Transformation



$$R_a = \frac{R_1 R_2}{R_1 + R_2 + R_3}$$

$$R_b = \frac{R_2 R_3}{R_1 + R_2 + R_3}$$

$$R_c = \frac{R_1 R_3}{R_1 + R_2 + R_3}$$

2. Maximum Power Transfer

$$P = \left[\frac{V_{TH}}{R_{TH} + R_L}\right]^2 R_L$$

3. Conversion rectangular to polar form:

$z = x + jy, \quad \theta = \tan^{-1}\frac{y}{x},$ (1st quadrant)

$z = -x + jy, \theta = 180° + \tan^{-1}\frac{y}{-x},$ (2nd quadrant)

$z = -x - jy, \theta = -180° + \tan^{-1}\frac{-y}{-x},$ (3rd quadrant)

$z = x - jy, \quad \theta = \tan^{-1}\frac{(-y)}{x}$ (4th quadrant)

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4. Trigonometric Identities:

$$\sin(-x) = -\sin x$$
$$\cos(-x) = \cos x$$
$$\sin(x \pm 90°) = \pm \cos x$$
$$\cos(x \pm 90°) = \mp \sin x$$
$$\sin(x \pm 180°) = -\sin x$$
$$\cos(x \pm 180°) = -\cos x$$

5. Mathematic operations for complex number:

Addition : $z_1 + z_2 = (x_1 + x_2) + j(y_1 + y_2)$
Substraction : $z_1 - z_2 = (x_1 - x_2) + j(y_1 - y_2)$
Multiplication : $z_1 z_2 = r_1 r_2 \angle(\theta_1 + \theta_2)$
Division : $\frac{z_1}{z_2} = \frac{r_1}{r_2}\angle(\theta_1 - \theta_2)$
Reciprocal : $\frac{1}{z} = \frac{1}{r}\angle(-\theta)$
Square root : $\sqrt{z} = \sqrt{r}\angle(\theta/2)$

6. Time domain representation

$$v = V_m \sin(\omega t \pm \theta)$$

Phasor domain representation

$$V = \frac{V_m}{\sqrt{2}}\angle(\pm\theta)$$

7. Impedance

$$Z = \frac{V}{I}$$

$$Z_R = R$$

$$Z_L = j\omega L$$

$$Z_C = \frac{1}{j\omega C}$$