UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	ELECTRICAL AND ELECTRONICS TECHNOLOGY
COURSE CODE	:	BDA14303
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	1. PART A (COMPULSORY): ANSWER **ALL** QUESTIONS 2. PART B (OPTIONAL): ANSWER **THREE (3)** QUESTIONS **ONLY**

THIS QUESTION PAPER CONSISTS OF **TWELVE (12)** PAGES

PART A

Q1 (a) Define the following terms and state its unit.

i) electrical energy
ii) electrical power

(4 Marks)

(b) A portable machine requires a force of 250N to move it. How much work is done if the machine is move 10 meter and what average power is utilized if the movement takes 5s?

(2 Marks)

(c) State the meaning of the following abbreviations of prefixes used with electrical units:

i) k
ii) μ
iii) m
iv) M

(4 marks)

(d) State the difference between passive and active element. Give two (2) examples of each passive sensor and active sensor.

(4 marks)

(e) Rewrite the following as indicated:

i) 1000 pF to nF
ii) 0.02 μF to pF
iii) 5000 kHz to Mhz
iv) 47kΩ to MΩ
v) 0.32 mA to μA
vi) 1000 Nm to kJ

(6 marks)

Q2 (a) Apply DeMorgan's Theorems to the following Boolean expression and simplify it.

$$Y = \overline{(A + \overline{\overline{B}C} + CD)} + \overline{\overline{BC}}$$

(10 marks)

(b) Reduce the function specified in the truth table of **Table Q2(b)** to its minimum sum-of-product (SOP) form using a Karnaugh map. Hence, draw the logic circuit using NAND gates only.

(10 marks)

PART B

Q3 (a) Refer to **Figure Q3(a)**, determine the power for the voltage source, dependent source, element 1, element 2 and element 3. For each case, indicate whether the power is absorbed or supplied. Let the voltage drop across element 2 to be 24 V.

(10 marks)

(b) Suppose the cost of electrical energy for your house is RM0.12/kW-hr, and your electric bill for the past month (30 days) was RM133.

i) What is the average power being used?

ii) If the voltage is 120 V, what is the average current being drawn?

iii) If part of the electrical use is a 100-W light bulb that is on continuously in the basement, what percentage of your electrical usage can be saved by turning it off?

(10 marks)

Q4 (a) Thévenin is a useful tool to simplify and analyze complex electronic circuit. Explain in detail the steps to carry out Thévenin analysis.

(4 marks)

(b) **Figure Q4(b)** shows a complex electronics circuit. Use the Thévenin method to find the Thévenin equivalent circuit with respect to 1nF capacitor.
Hint: use superposition to find V_{th}.

(8 marks)

(c) Refer **Figure Q4(c)**, find the Norton Equivalent Circuit with respect to the 3kΩ resistor in the middle of the circuit. The 3kΩ resistor itself should not be part of the equivalent circuit that you compute.

(6 marks)

(d) Based on the result that you compute in part Q4(c), determine the Thévenin equivalent circuit for this circuit.

(2 marks)

Q5 (a) Using source transformations, find the voltage across resistor R_3 in the circuit shown in **Figure Q5(a).**

(10 marks)

(b) Using mesh analysis, determine the current supplied by each battery in the given circuit shown in **Figure Q5(b).** For each battery state whether it is in the charging or discharging state.

(10 marks)

Q6 (a) A 50.0Ω resistor (R), a 0.100 H (L) inductor and a 10.0μF capacitor (C) are connected in series to a 60.0 Hz source (V) as shown in **Figure Q6(a)**. The rms current, I_{rms} in the circuit is 2.75A.

i) Find the rms voltage across the resistor, inductor and capacitor

(6 marks)

ii) Find the rms voltage across the RLC combination

(2 marks)

iii) Sketch the phasor diagram for this circuit

(4 marks)

(b) Calculate the RMS value and average value of the voltage wave shown in **Figure Q6(b).**

(8 marks)

Q7 (a) Find the maximum energy stored in the capacitor in **Figure Q7(a)**.

(5 marks)

(b) Refer to **Figure Q7(a)**, how much energy disappear to the resistor? Determine the expression for the energy (without solving it).

(5 marks)

(c) Simplify the circuit in **Figure Q7(c)** to a single inductor and a single capacitor. Determine the equivalent capacitance and inductance.

(10 marks)

-END OF QUESTIONS-

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY

PROGRAMME CODE: BDD
COURSE CODE: BDA14303

INPUTS A B C	OUTPUT X
0 0 0	1
0 0 1	1
0 1 0	0
0 1 1	1
1 0 0	1
1 0 1	1
1 1 0	0
1 1 1	1

Table Q2(b)

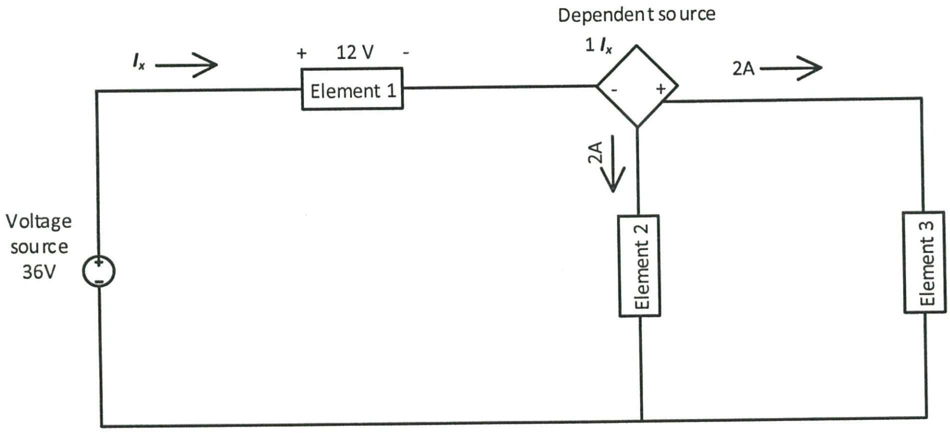


Figure Q3(a)

TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY

PROGRAMME CODE: BDD
COURSE CODE: BDA14303

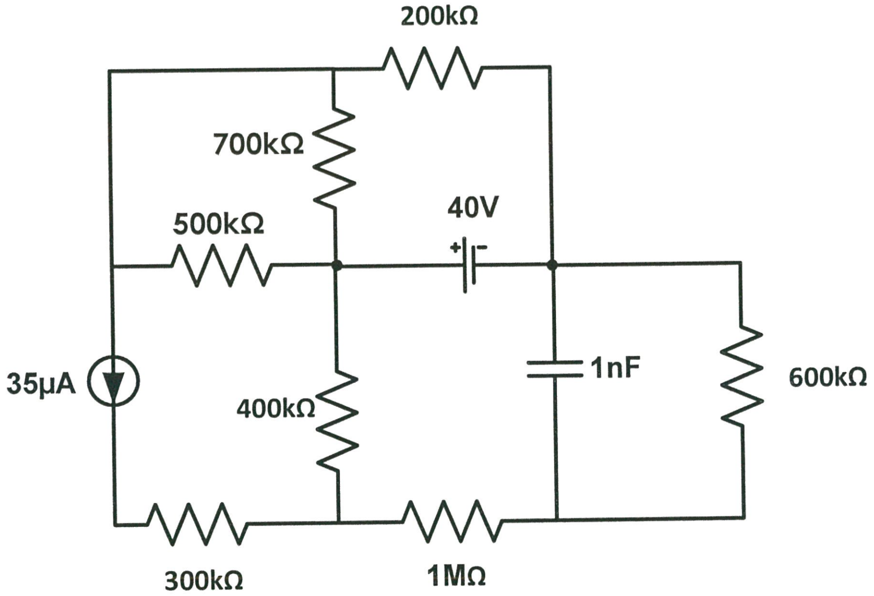


Figure Q4(b)

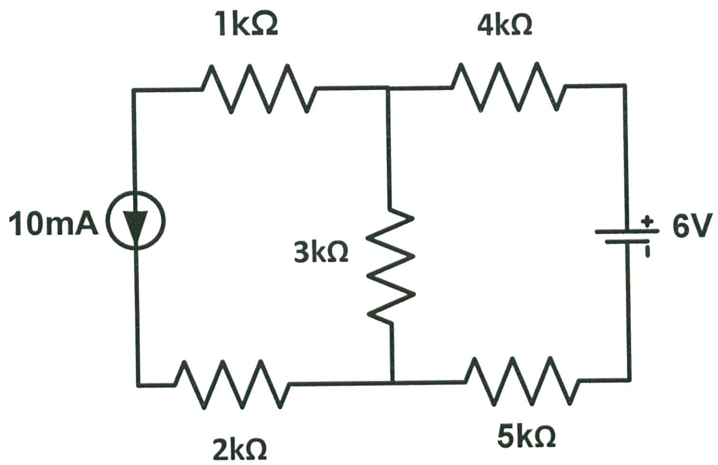


Figure Q4(c)

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY
PROGRAMME CODE: BDD
COURSE CODE: BDA14303

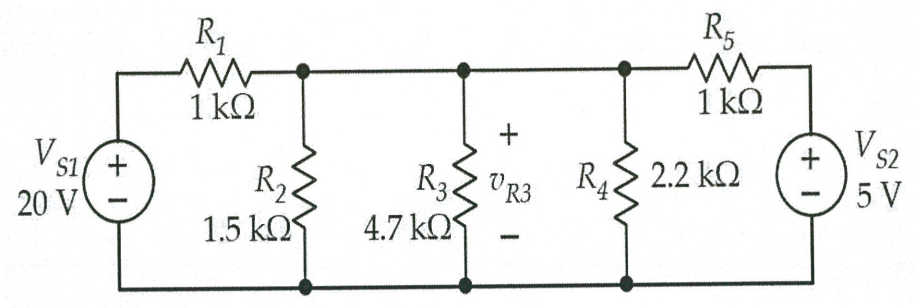


Figure Q5(a)

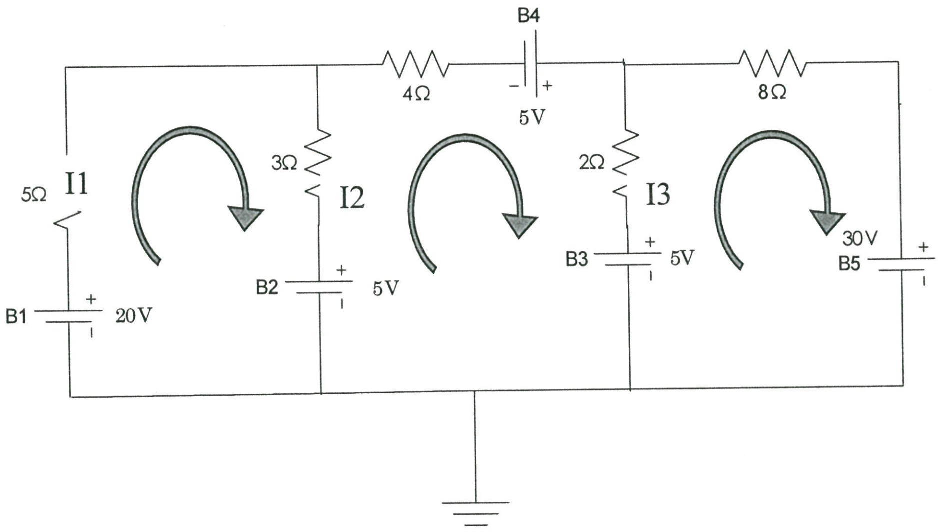


Figure Q5(b)

TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY

PROGRAMME CODE: BDD
COURSE CODE: BDA14303

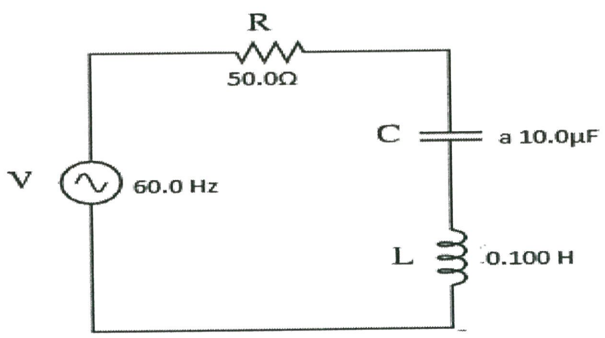


Figure Q6 (a)

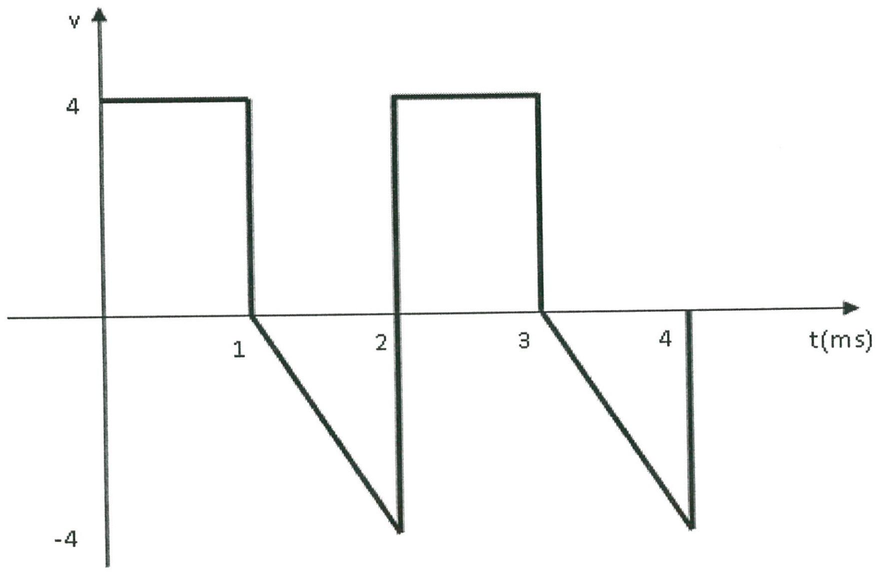


Figure Q6 (b)

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY
PROGRAMME CODE: BDD
COURSE CODE: BDA14303

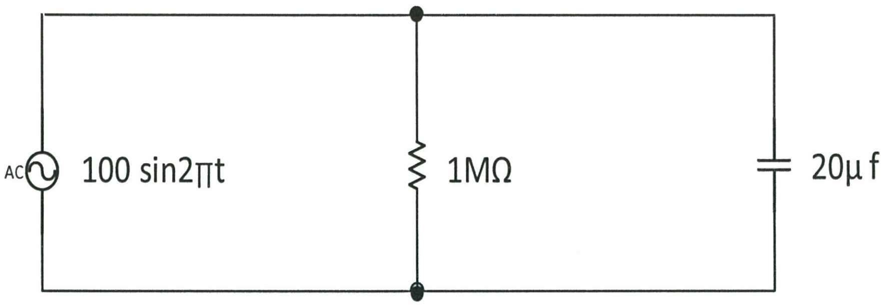


Figure Q7 (a)

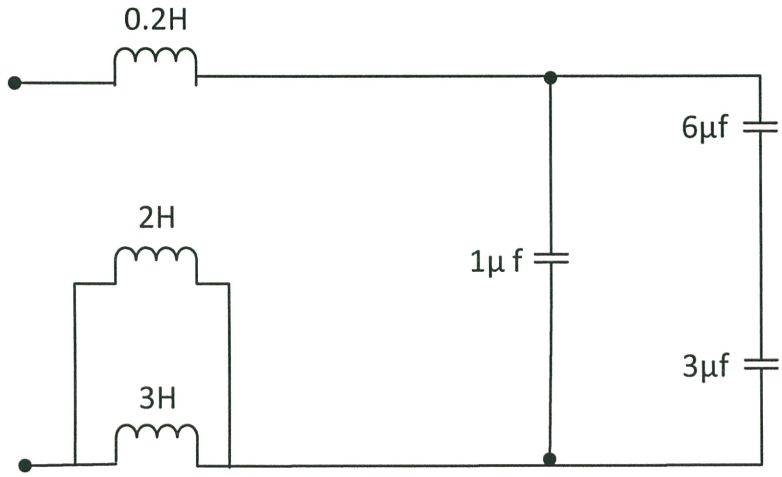


Figure Q7 (c)

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY

PROGRAMME CODE: BDD
COURSE CODE: BDA14303

LIST OF FORMULA

OHMS LAW

$$V = IR$$

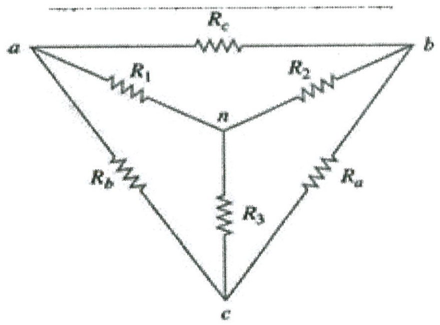
JOULE'S LAW

$$P = IV$$

KIRCHHOFF LAW

$$\sum_{k=1}^{n} i_k = 0 \qquad \sum_{v=1}^{n} v_k = 0$$

WYE-DELTA TRANSFORMATION

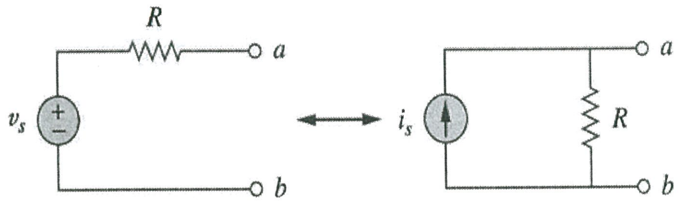


$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1} \qquad R_1 = \frac{R_bR_c}{R_a + R_b + R_c}$$

$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2} \qquad R_2 = \frac{R_cR_a}{R_a + R_b + R_c}$$

$$R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3} \qquad R_1 = \frac{R_aR_b}{R_a + R_b + R_c}$$

SOURCE TRANSFORMATION



$$V_S = I_s R$$

THEVENIN AND NORTON EQUIVALENT CIRCUIT

$$R_{TH} = R_N \qquad IN = \frac{V_{TH}}{R_{TH}}$$

$$P = i^2 R_L = \left(\frac{V_{TH}}{R_{TH} + R_L}\right)^2 R_L$$

When $R_L \neq R_{TH}$

$$P_{\max} = \frac{V_{TH}{}^2}{4R_{TH}}$$

When $R_L = R_{TH}$

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY

PROGRAMME CODE: BDD
COURSE CODE: BDA14303

CAPACITOR AND INDUCTOR

$$C = \frac{\varepsilon A}{d}$$

$$v(t) = \frac{1}{C}\int_{-\infty}^{t} i(t)dt + v(t_0)$$

$$i = C\frac{dv}{dt}$$

$$w = \frac{1}{2}Cv^2$$

$$L = \frac{N^2 \mu A}{l}$$

$$v = L\frac{di}{dt}$$

$$i = \frac{1}{L}\int_{t_0}^{t} v(t)dt + i(t_0)$$

$$w = \frac{1}{2}Li^2$$

$$\tau = RC$$

$$\tau = \frac{L}{R}$$

PHASOR REALTIONSHIP

$$v(t+T) = v(t)$$

$$f = \frac{1}{T}$$

$$z = x + jy = r\angle\phi = r(\cos\phi + j\sin\phi)$$

ALTERNATING CURRENT POWER CALCULATION

$$P(t) = v(t)i(t)$$ Instantaneous power

$$P = \frac{1}{2}\mathrm{Re}[VI^*] = \frac{1}{2}V_m I_m \cos(\theta_v - \theta_i)$$ Average power

$$i_{RMS} = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$$

$$P_{RMS} = I_{RMS}{}^2 R = \frac{V_{RMS}{}^2}{R}$$

TRANSFORMERS

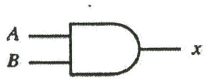
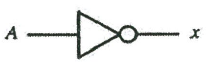
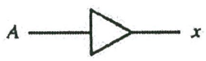
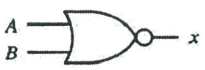
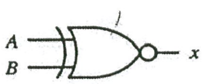
$$\frac{V_P}{V_S} = \frac{N_P}{N_S}$$

FINAL EXAMINATION

SEMESTER / SESSION: SEM II / 2016/2017
COURSE NAME: ELECTRICAL AND ELECTRONICS TECHNOLOGY

PROGRAMME CODE: BDD
COURSE CODE: BDA14303

LOGIC GATES

Name	*Graphic symbol*	*Algebraic function*	*Truth table*
AND		$x = A \cdot B$ or $x = AB$	A B | x 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1
OR		$x = A + B$	A B | x 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1
Inverter		$x = A'$	A | x 0 | 1 1 | 0
Buffer		$x = A$	A | x 0 | 0 1 | 1
NAND		$x = (AB)'$	A B | x 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0
NOR		$x = (A + B)'$	A B | x 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0
Exclusive-OR (XOR)		$x = A \oplus B$ or $x = A'B + AB'$	A B | x 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0
Exclusive-NOR or equivalence		$x = (A \oplus B)'$ or $x = A'B' + AB$	A B | x 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 1