Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	ELECTRICAL AND ELECTRONIC TECHNOLOGY
COURSE CODE	:	BDA 14303 / BEX 17003
PROGRAMME	:	BACHELOR OF MECHANICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS IN **SECTION A**. WRITE ANSWER IN THE ANSWER SHEET (PAGE 6). 2. ANSWER **FOUR** QUESTIONS ONLY IN **SECTION B**. WRITE ANSWER IN THE PROVIDED SPACE. 3. RETURN THIS QUESTION PAPER.

THIS QUESTION PAPER CONSISTS OF **EIGHTEEN (18)** PAGES

SECTION A

Q1 A hair dryer draws 5A from a 240V line. Find the resistance of the dryer.

(a) 1200 Ω
(b) 48 Ω
(c) 0.0208 Ω
(d) Undetermined

(2 marks)

Q2 A water pump connected to a 240V line draws 0.24A. Find its power consumption.

(a) 0.24W
(b) 57.6W
(c) 4.167W
(d) Undetermined

(2 marks)

Q3 Find the total resistance for the circuit in **Figure Q3** at terminal A-C.

(a) 1.91 Ω
(b) 2.18 Ω
(c) 1.64 Ω
(d) None above

(2 marks)

Q4 Find the total resistance for the circuit in **Figure Q3** at terminal D-E.

(a) 1.64 Ω
(b) 1.91 Ω
(c) 2.18 Ω
(d) None above

(2 marks)

Q5 Find the total resistance for the circuit in **Figure Q3** at terminal B-C.

(a) 2.18 Ω
(b) 1.91 Ω
(c) 1.64 Ω
(d) None above

(2 marks)

Q6 Solve the voltage across 3Ω resistor in **Figure Q6**.

(a) 4.44 V
(b) 5.56 V
(c) 3.75 V
(d) None above

(2 marks)

Q7 Solve the current through 5Ω resistor in **Figure Q6**.

(a) 1.11 A
(b) 0.37 A
(c) 4.44 A
(d) None above

(2 marks)

Q8 Find the power dissipated at 5Ω resistor in **Figure Q6**.

(a) 6.16 W
(b) 0.68 W
(c) 98.57 W
(d) None above

(2 marks)

Q9 Define the relation between $V_{5\Omega}$, $V_{6\Omega}$ and $V_{9\Omega}$ for the circuit in **Figure Q6**.

(a) $V_{5\Omega} > V_{6\Omega} > V_{9\Omega}$
(b) $V_{6\Omega} > V_{5\Omega} > V_{9\Omega}$
(c) $V_{5\Omega} > V_{9\Omega} > V_{6\Omega}$
(d) None above

(2 marks)

Q10 Solve the current through 9Ω for circuit in **Figure Q10**.

(a) 2.73 A
(b) 2.36 A
(c) 4.50 A
(d) None above

(2 marks)

Q11 Solve i_2 for circuit in **Figure Q11**.

(a) 2.92 A
(b) 0 A
(c) 2.08 A
(d) 5.00 A

(2 marks)

Q12 Select the correct method for obtaining Thevenin resistance.

(a) Both voltage and current sources are 'open'.

(c) Voltage sources are 'open' and current sources are 'shorted'.

(b) Voltage sources are 'shorted' and current sources are 'open'.

(d) Both voltage and current sources are 'shorted'.

(2 marks)

Q13 Identify a dielectric material which is suitable for the construction of capacitor.

(a) Tantalum (c) Copper

(b) Aluminium (d) Paper

(2 marks)

Q14 Find the total capacitance for circuit in **Figure Q14**.

(a) 15 F (c) 3.33 F

(b) 7.50 F (d) None above

(2 marks)

Q15 Find the total inductance for circuit in **Figure Q15**.

(a) 15 H (c) 3.33 H

(b) 7.50 H (d) None above

(2 marks)

Q16 **Figure Q16** shows a typical alternate current waveform. Identify the waveform period.

(2 marks)

Q17 Select the parameter which CANNOT be changed by a transformer.

(a) Voltage (c) Current

(b) Power (d) None above

(2 marks)

Q18 Select the electric motor which is NOT an AC motor.

(a) Stepper motor (c) Synchronous motor

(b) Induction motor (d) None above

(2 marks)

Q19 Choose the logic gate for the given input and output in **Figure Q19**.

(a) Buffer
(b) AND
(c) NOR
(d) None above

(2 marks)

Q20 Choose the logic gate for the given input and output in **Figure Q20**.

(a) NAND
(b) X-OR
(c) X-NOR
(d) None above

(2 marks)

SECTION A ANSWER SHEET

Q1	
Q2	
Q3	
Q4	
Q5	
Q6	
Q7	
Q8	
Q9	
Q10	

Q11	
Q12	
Q13	
Q14	
Q15	
Q16	
Q17	
Q18	
Q19	
Q20	

SECTION B

Q21 (a) Construct a basic transformer structure. Identify and label the core, primary winding and secondary winding.

(3 marks)

(b) Compare between a step-up transformer and a step-down transformer.

(2 marks)

(c) An ideal transformer is rated at 2400/120 V, 9.6 kVA, and has 50 turns on the secondary side. Calculate:

(i) The turn ratio.

(3 marks)

(ii) The number of turn on the primary side.

(3 marks)

(iii) The current rating for primary and secondary winding.

(4 marks)

Q22 (a) Evaluate the logic circuit in **Figure Q27** and obtain the Boolean expression for Z.

(6 marks)

(b) Analyse the logic circuit in **Figure Q27** and fill in the truth table below.

(9 marks)

A	B	C	Z

Q23 (a) Compare four characteristics of AC and DC motors.

(8 marks)

(b) Construct the general equivalent circuit of a DC motor.

(7 marks)

Q24 (a) Referring to **Figure Q24**, analyse the current and power absorbed by the 8Ω resistor using source transformation method.

(8 marks)

(b) Illustrate and explain the concept of maximum power transfer.

(7 marks)

Q25 **Figure Q25(a)** shows the input of AC supply voltage which is given in rms. Its signal is shown in **Figure Q25(b)**. Determine for:

(a) period (T).

(b) frequency (Hz).

(c) rms current.

(d) rms, peak and peak-peak voltages across 500Ω resistor.

(e) sketch the current waveform and label the peak current.

(15 marks)

Q26 (a) Construct the Norton equivalent circuit for the circuit in **Figure Q26** with referring to terminal A-B.

(9 marks)

(b) List down three factors which determine the value of capacitance.

(6 marks)

- END OF QUESTIONS -

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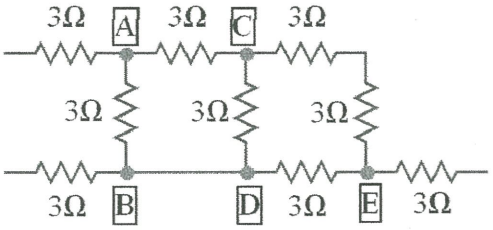

FIGURE Q3

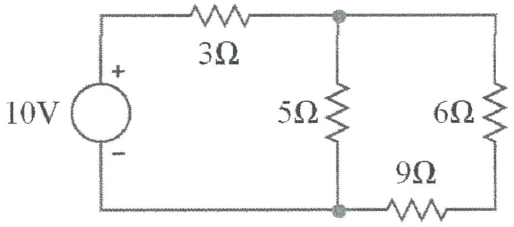

FIGURE Q6

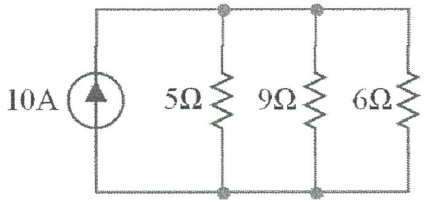

FIGURE Q10

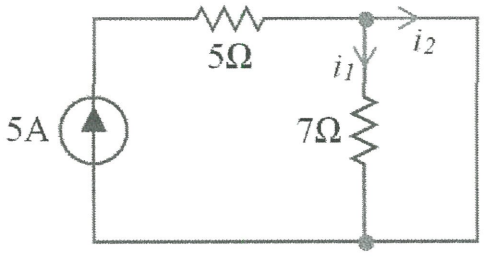

FIGURE Q11

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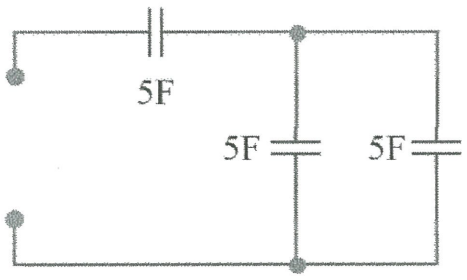

FIGURE Q14

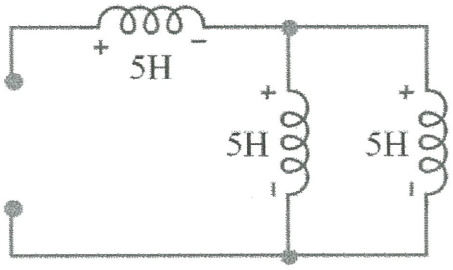

FIGURE Q15

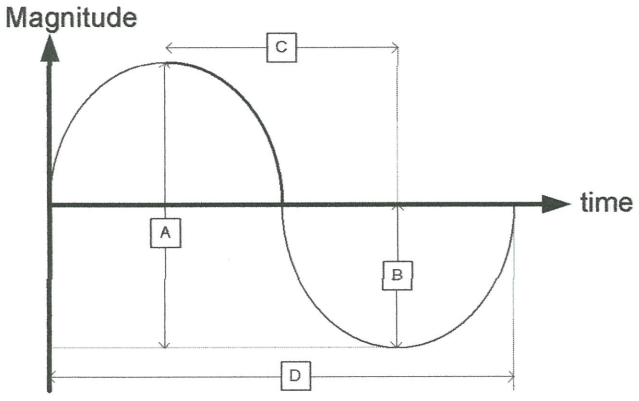

FIGURE Q16

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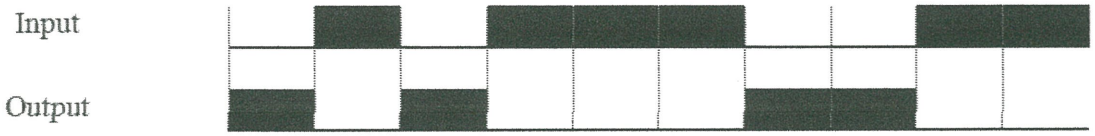

FIGURE Q19

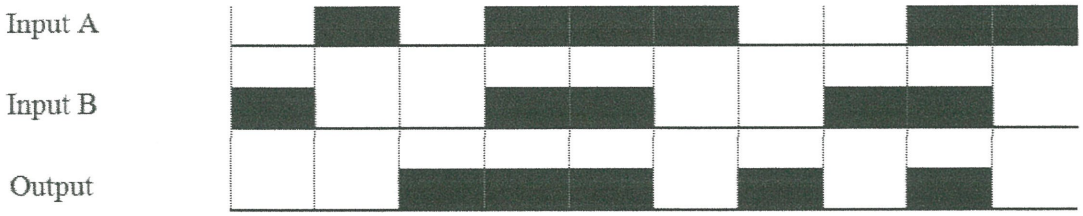

FIGURE Q20

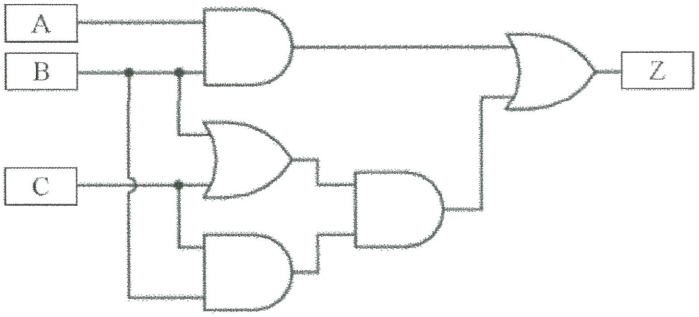

FIGURE Q22

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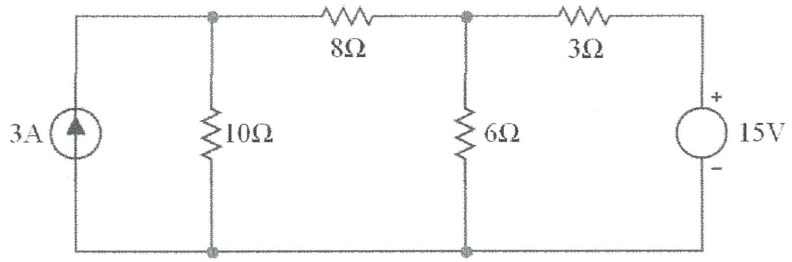
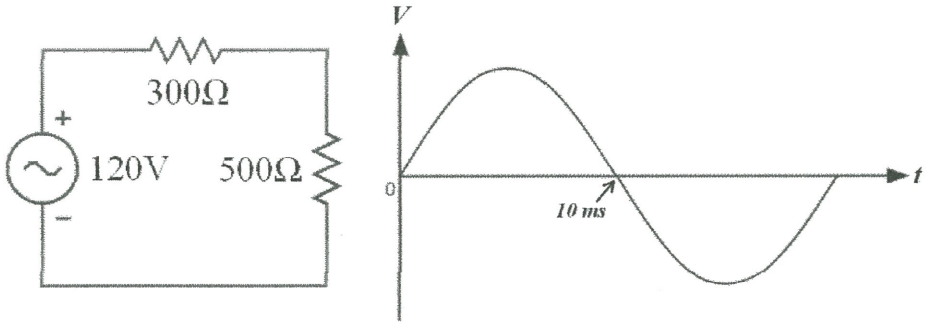


FIGURE Q24



(a) **(b)**

FIGURE Q25

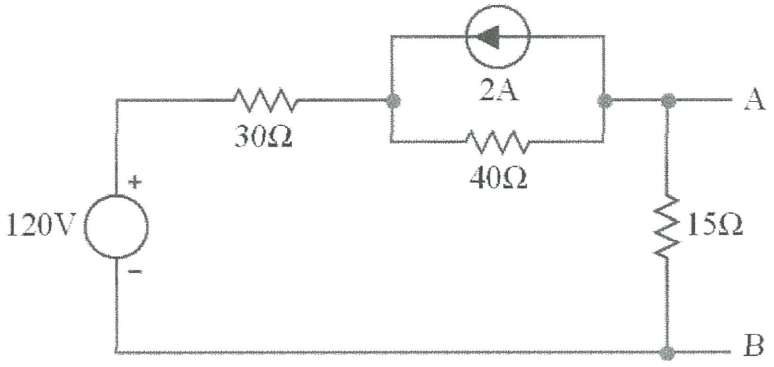


FIGURE Q26

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LIST OF FORMULA

OHMS LAW

$$V = IR$$

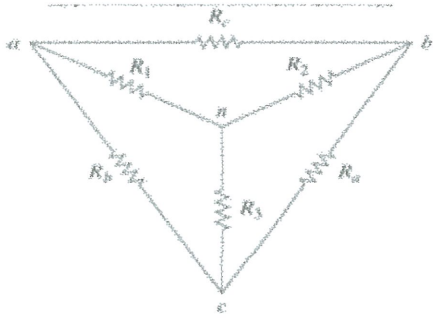
JOULE'S LAW

$$P = IV$$

KIRCHHOFF LAW

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

WYE-DELTA TRANSFORMATION



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

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

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

CAPACITOR AND INDUCTOR

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

$$i = C\frac{dv}{dt} \qquad w = \frac{1}{2}Cv^2$$

$$L = \frac{N^2\mu A}{l} \qquad v = L\frac{di}{dt}$$

$$i = \frac{1}{L}\int_{t_0}^{t} v(t)dt + i(t_0) \qquad w = \frac{1}{2}Li^2$$

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

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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

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

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

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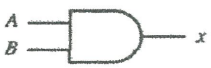
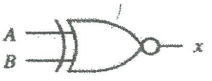
LOGIC GATES

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