Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	ELECTRICAL TECHNOLOGY
COURSE CODE	:	DAE 11003
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

Q1 (a) List **three (3)** particles in an atom (3 marks)

(b) The amount of electrons that flow through a wire in 50 ms is 6.87×10^8C. Calculate the current in amperes.

(2 marks)

(c) Find the total conductance, G for each of the following resistances values:

(i) ? kΩ resistor and 4 kΩ resistor connected in series.

(2 marks)

(ii) 10 Ω resistor and 20 Ω resistor connected in parallel.

(2 marks)

(d) Determine the voltage of a battery that uses 1000 J of energy to move 25C of charge through a resistor.

(2 marks)

(e) A portable player of MP3 using a 12 V, 4.5 Ah rechargable battery. It can operate for a period of 6.5 hours.

(i) Find the current drawn from the battery during this period.

(2½ marks)

(ii) Determine the amount of charge delivered by the battery in Coulombs.

(2½ marks)

(f) Referring to **Figure Q1(f),**

(i) Calculate the currents i, i_1, and i_2.

(4 marks)

(ii) Determine the voltages at V_1, V_2, V_3, V_4 and V_5 using current and voltage divider formulas.

(5 marks)

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Q2 (a) Three resistors R_1, R_2 and R_3 are connected in series with a 20 V source. The value of resistor R_1 is 4 kΩ, the voltage across resistor R_2 is 10 V and the current flowing through resistor R_3 is 2 mA.

(i) Draw the circuit.

(1 mark)

(ii) Determine the value of voltage across resistor R_1.

(1½ marks)

(iii) Calculate the value of resistors R_2 and R_3.

(3½ marks)

(b) A parallel combination of two 50 Ω resistors and a resistor R_1, is connected in series with a 10 Ω resistor. A 20 V supply is applied across the circuit and 1.5 A of current is measured flowing out of the voltage supply.

(i) Draw the circuit. (1½ marks)

(ii) Calculate the values of resistor R_1.

(4½ marks)

(c) Referring to **Figure Q2(c)** , Calculate the values of currents I_R, I_{2R}, I_{3R} and I_{4R}.

(9 marks)

(d) Determine the minimum value of 100 Ω rheostat in **Figure Q2(d)** that can be adjusted before the fuse of 0.5 A blows.

(4 marks)

Q3 (a) Four batteries which are connected in series produce 20 mA in the circuit. Each of the battery has the voltage of 9 V. Determine the power in the circuit.

(3 marks)

(b) Referring to the circuit in **Figure Q3(b),** determine the followings:

(i) Construct the table for 10 sets of values for resistance, R and current, I .

(5 marks)

(ii) Sketch a graph of current, I versus resistance, R based on your answer in **Q3(b)(i)** above.

(4 marks)

(iii) Write the conclusion based on your answer in **Q3(b)(ii).**

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(4 marks)

(c) Referring to **Figure Q3(c)**, given that the total power, $P_T = 24.5$ mW, the total resistance, $R_T = 8$ kΩ, and the currents, , $I_4 = 0.8$ mA, $I_3 = 0.4$ mA, $I_2 = 0.25\ I_1$. Calculate the values of resistance, R_1, R_2, R_3 and R_4 .

(9 marks)

Q4 (a) A magnetic field has the cross-sectional area of 1.9 m^2 and the magnetic flux is 1300 μWb. Calculate the flux density.

(2 marks)

(b) The current flowing through 15 turns of wire is 6 A. Determine the following:

(i) Magnetomotive force (m.m.f) (2 marks)

(ii) Reluctance of the circuit if the flux is 500 μWb

(2 marks)

(c) By referring to **Figure Q4(c),** determine the followings:

(i) Magnetizing force (H) (4 marks)

(ii) Magnetic flux (Φ) (7 marks)

(iii) Magnetic flux density (B) (2 marks)

(d) Determine the flux established in the magnetic path of **Figure Q4(d),** if the reluctance of the material is 28 x 10^3 At/Wb.

(2 marks)

(e) By Referring to **Figure Q4(e),** determine the following:

(i) Flux density in the core.

(2 marks)

(ii) Show the north and south poles of the magnet

(2 marks)

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Q5 (a) Determine the turns ratio of the transformer having 150 turns in its primary winding and 600 turns in its secondary winding.

(2 marks)

(b) The primary winding of a transformer has 1500 V across it. Calculate the secondary voltage if the turns ratio is 0.125.

(2 marks)

(c) Given a transformer with the input power to the primary is 150 W. If 10.5 W are dissipated in the winding resistances, calculate the output power to the load. Neglecting any other losses.

(2 marks)

(d) Determine the value to which R_L must be adjusted in **Figure Q5(d)** for maximum power transfer. The internal resistance of the source is 100 Ω.

(3 marks)

(e) Determine the phase of the primary voltage with respect to the secondary voltage for each transformer in **Figure Q5(e)(i), (ii)** and **(iii)**

(4 marks)

(f) Complete the following questions:

(i) Calculate the mutual inductance (L_M) when k = 0.5, L_1 = 2.5 µH and L_2 = 8 µH.

(2 marks)

(ii) Calculate the coefficient of coupling (k), when L_M = 2 µH, L_1 = 6 µH and L_2 = 3.5 µH.

(2 marks)

(f) Determine the following quantities by referring to **Figure Q5(g)** :

(i) Primary current, I_P. (2 marks)

(ii) Secondary current, I_S. (2 marks)

(iii) Secondary voltage, V_S. (2 marks)

(iv) Power in load, P_L. (2 marks)

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Q6 (a) Determine the frequency for the following angular velocity:

(i) 1256 rad/s
(ii) 68 rad/s

(2 marks)

(b) Solve the following complex numbers in rectangular form:

(i) $\frac{25\angle 60°}{3-j4}+\text{j}8$

(2 marks)

(ii) $21+(8\angle 30°)(5-j10)$

(2 marks)

(iii) $3+\frac{4+j5}{5-j8}$

(2 marks)

(c) In the linear circuit, the voltage source is Vs = 20 Sin (10^5t + 60^o) V. Determine the followings:

(i) Angular frequency of the voltage. (1 mark)

(ii) Frequency of the source. (2 marks)

(iii) Period of the voltage. (2 marks)

(d) Given the complex impedances $Z_1 = 3 + j4$ and $Z_2 = -12 + j5$, calculate:

(i) $\frac{Z_1+Z_2}{Z_1-Z_2}$

(ii) Z_1Z_2

(iii) $\frac{Z_1}{Z_2}$

(6 marks)

(e) A sinusoidal current has an rms value of 7 mA. Determine the following values:

(i) I_{peak}, I_p (2 marks)

(ii) $I_{average}$, I_{ave} (2 marks)

(iii) $I_{peak\ to\ peak}$, $I_{p\text{-}p}$ (2 marks)

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- END OF QUESTION-

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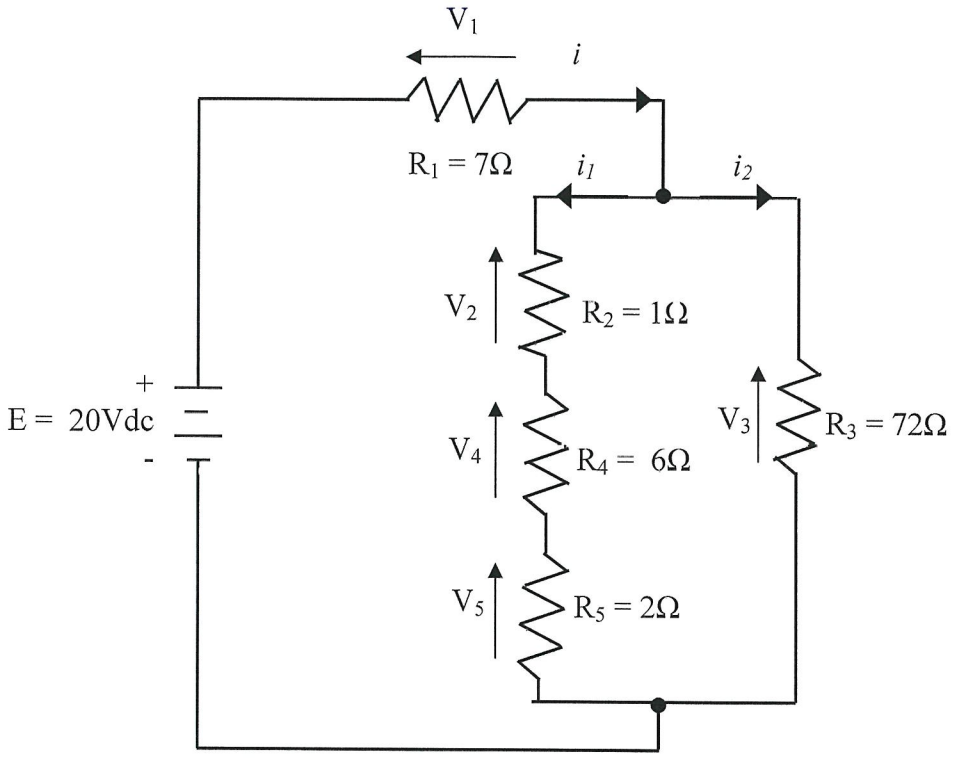

Figure Q1(f)

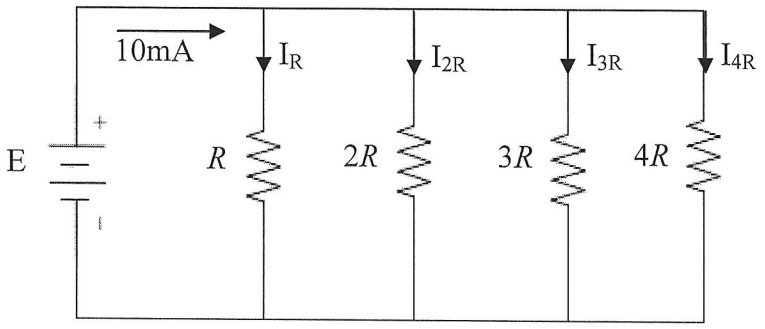

Figure Q2(c)

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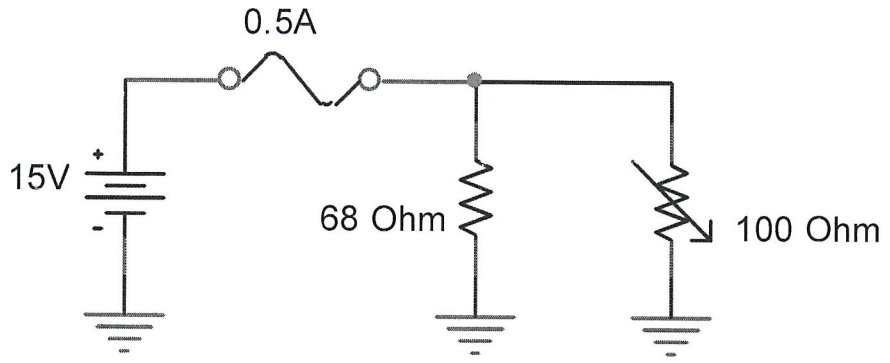

Figure Q2(d)

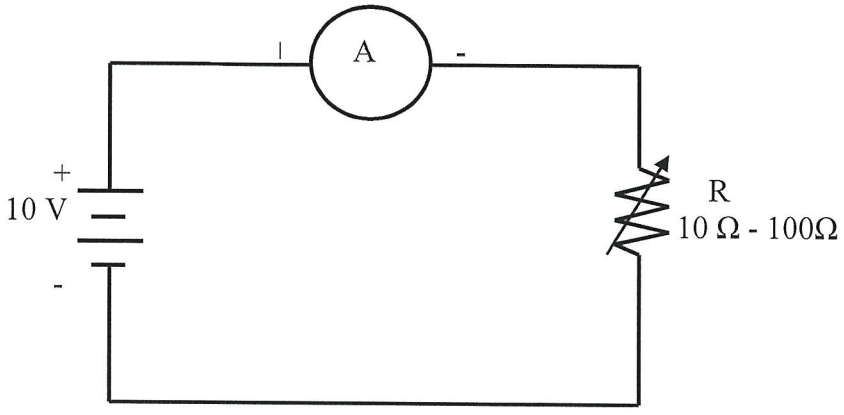

Figure Q3(b)

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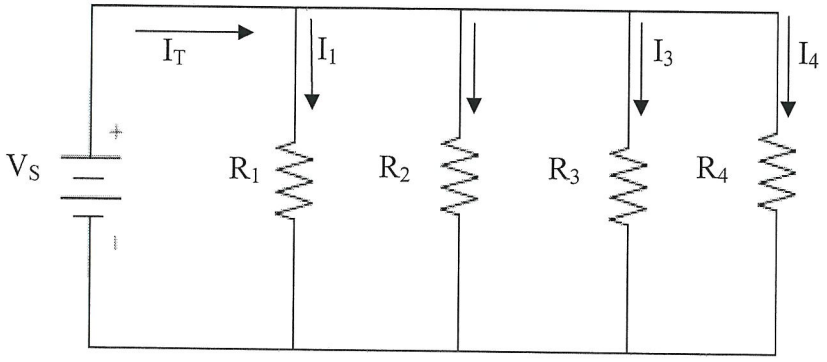

Figure Q3(c)

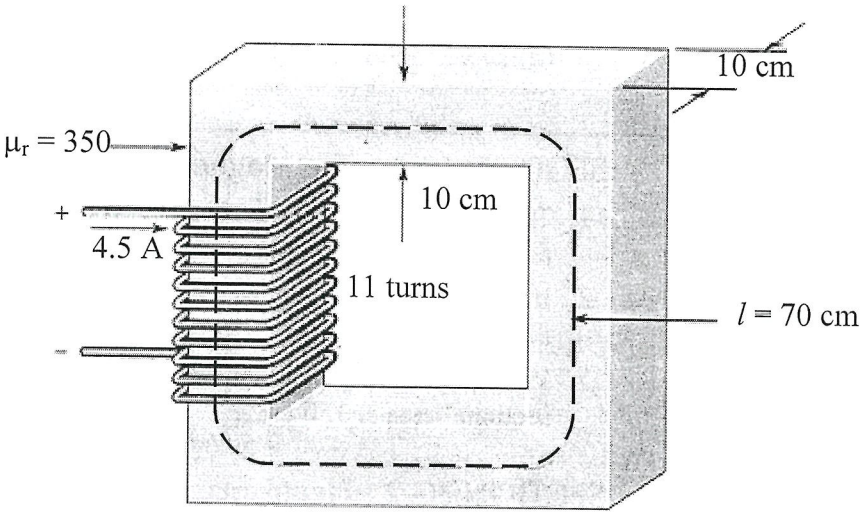

Figure Q4(c)

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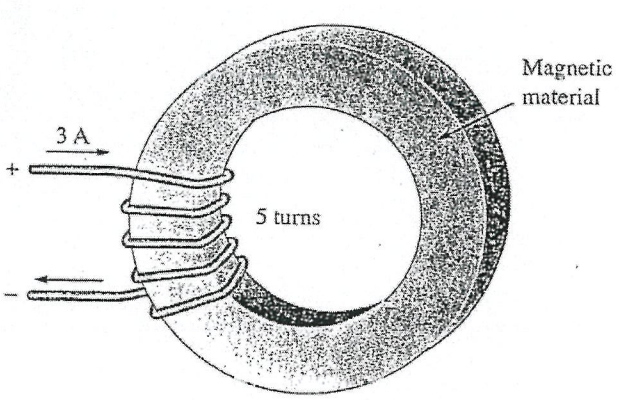

Figure Q4(d)

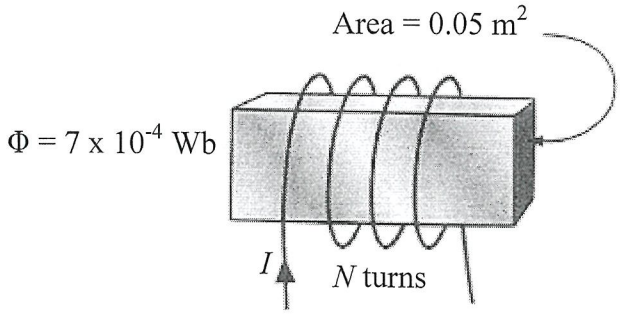

Figure Q4(e)

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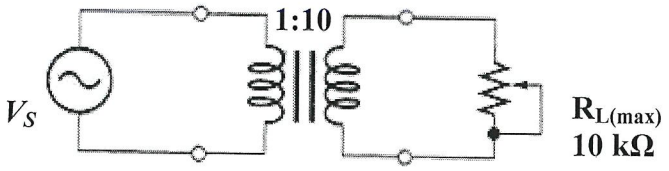

Figure Q5(d)

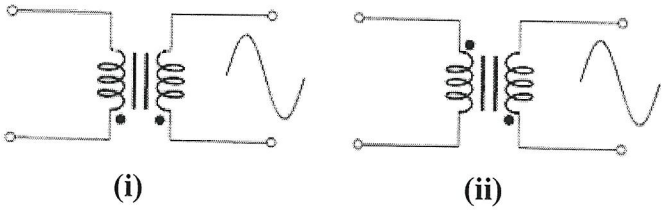

Figure Q5(e) (i), (ii) and (iii)

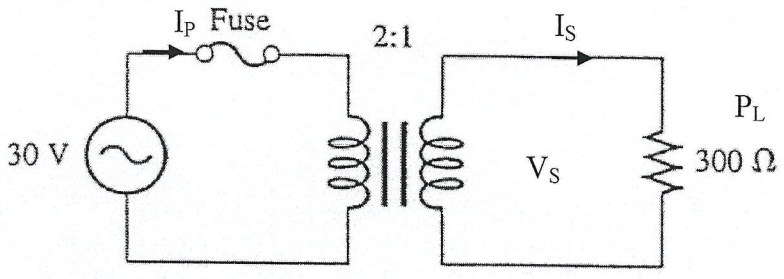

Figure Q5(g)

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