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FINAL
Examination Paper

(COVER PAGE)

Session	:	January 2017
Programme	:	Diploma In Electrical And Electronic Engineering (DEEI)
Course	:	**EEE1105: Circuit Theory and Electronic Devices**
Date of Examination	:	6 March 2017 (Monday)
Time	:	2:00pm – 4:00pm Reading Time : Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Nil

Examiner(s) : **Ch'ng Siew Peng**

Moderator : Kevin Tan Geok Su

*This paper consists of **10** printed pages, including the cover page.*

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
EEE1105: CIRCUIT THEORY AND ELECTRONIC DEVICES
FINAL EXAMINATION: JANUARY 2017 SESSION

Instructions: This paper consists of SIX (6) questions. Answer **any FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Find the Thevenin's and Norton's equivalent circuit with respect to terminal a and b for the circuit in Figure Q1 (a). (15 marks)

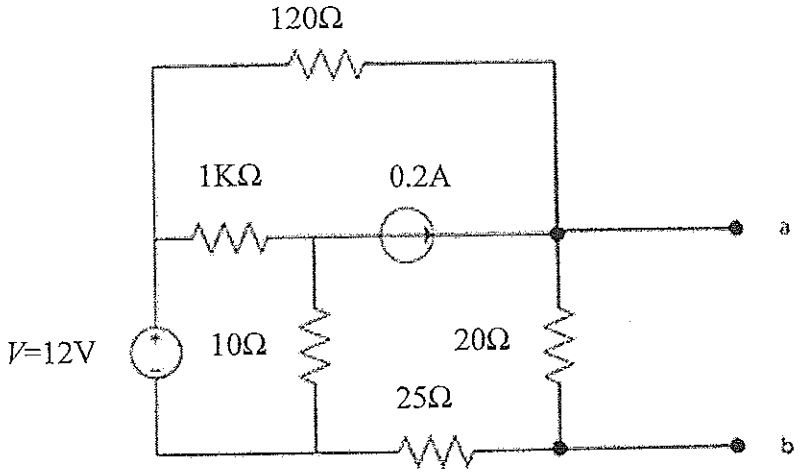


Figure Q1 (a)

(b) Use nodal analysis to find the voltage at each node of the circuit in Figure Q1 (b). Redraw the circuit with all the nodes labeled. (10 marks)

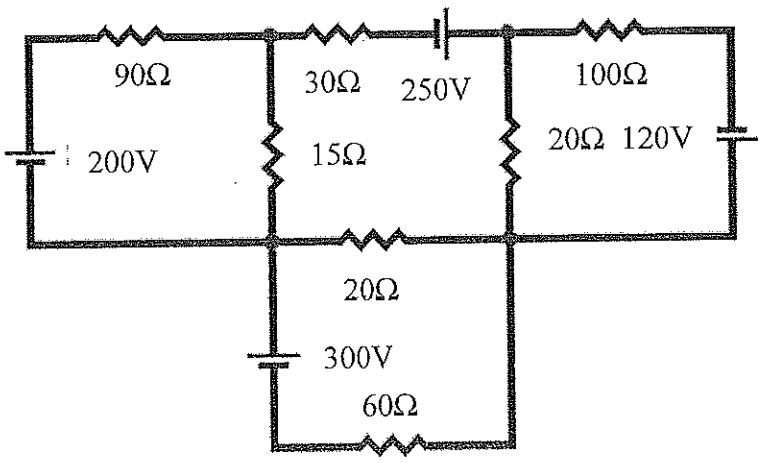


Figure Q1 (b)

Question 2

(a) Find the phasor voltage and current through each element for the circuit in Figure Q2 (a). (10 marks)

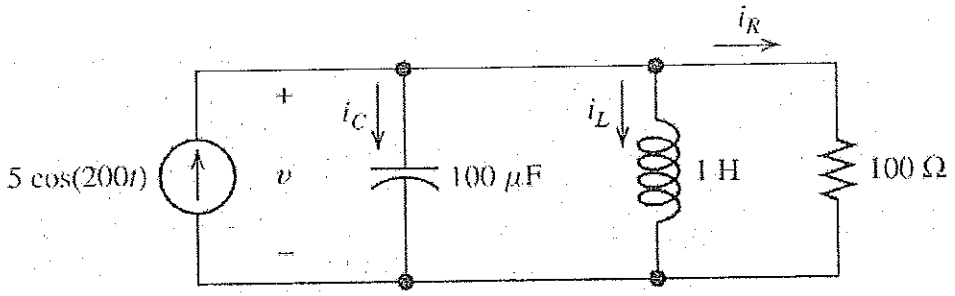


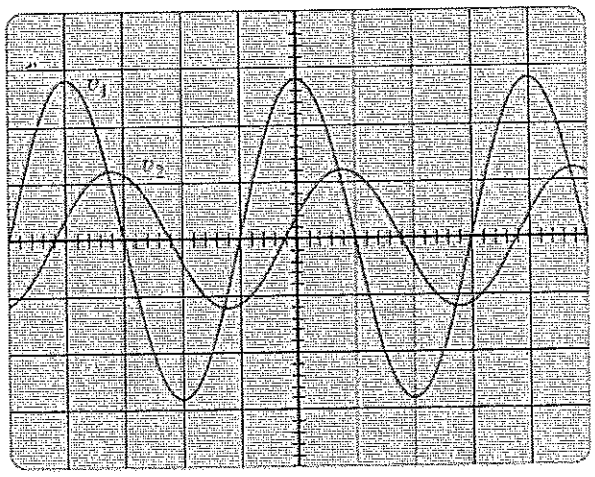
Figure Q2 (a)

(b) For the oscilloscope traces in Figure Q2(b),

(i) Determine the phase relationship between the waveforms, and indicate which one leads or lags. (4 marks)

(ii) Determine the rms values of each waveform. (2 marks)

(iii) Find the frequency of each waveform. (1 mark)



Vertical sensitivity = 0.5 V/div.
Horizontal sensitivity = 0.2 ms/div.

Figure Q2(b)

(c) Refer to the AC network in Figure Q2(c), given the supply rms value E=208 $\angle 0^{\circ} V$ .Calculate the average power, apparent power, reactive power, and power factor for motor and capacitive load. (8 marks)

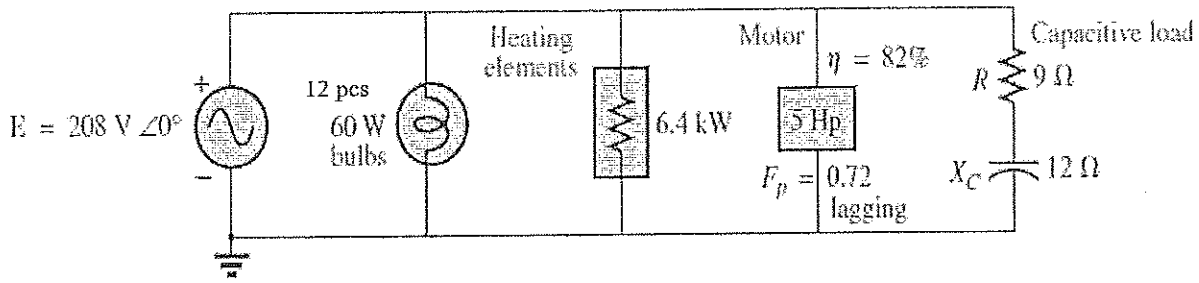


Figure Q2(c)

Question 3

(a) Explain the process of forming **N-Type** semiconductor. Give one examples of the **N-Type** impurity atoms and sketch the impurity atoms in a silicon crystal structure. (5 marks)

(b) By referring to Figure Q3(b), determine

(i) The voltages at references V_{01} and V_{02}. (4 marks)

(ii) The current through LED and the power delivered by the supply. (3 marks)

(iii) How does the power absorbed by the LED compare to that 6V Zener diode. (3 marks)

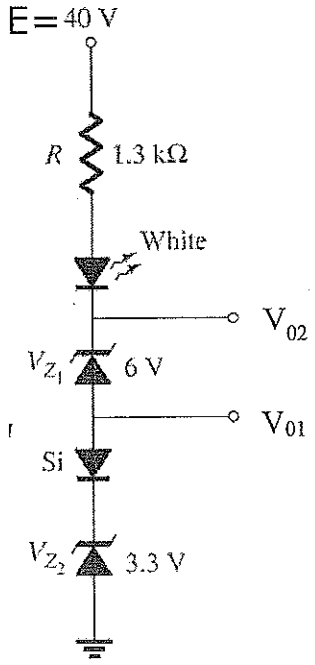


Figure Q3(b)

(c) The LED in Figure Q3(c)(I) has a light-producing characteristic of Radiant power versus forward current, I_F as shown in part (II). Assuming the forward voltage drop of the LED is 1.2V, determine the amount of radiant (light) power produced in mW. (4 marks)

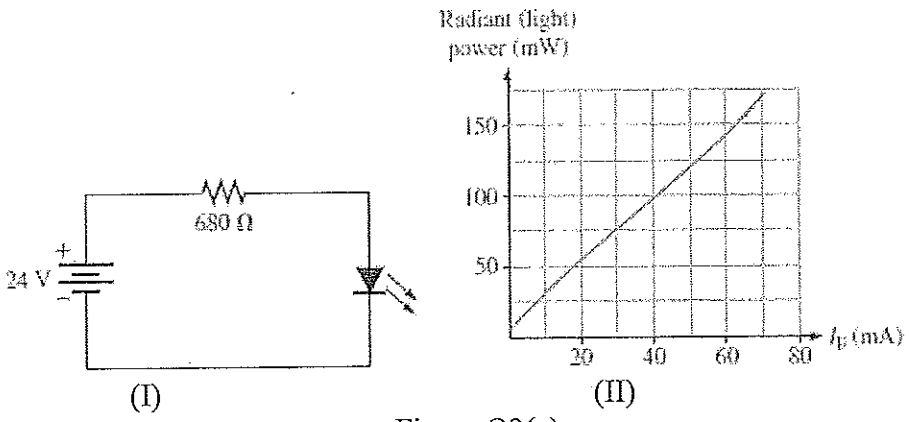


Figure Q3(c)

(d) The Zener diode in the voltage-regulator circuit of Figure Q3 (d) has a constant reverse breakdown voltage $V_Z = 8.2V$, for $75mA \leq i_Z \leq 1A$. If $R_L = 9\Omega$, find the range of R_S so that V_Z is regulated to (maintained at) 8.2V while $V_{IN} = 12V$. (6 marks)

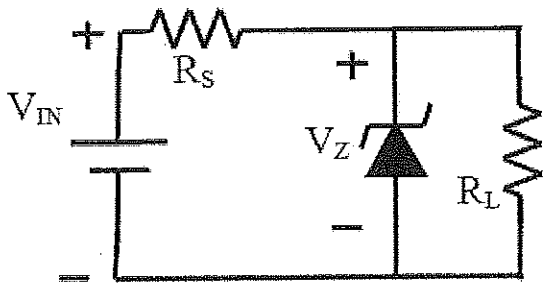


Figure Q3 (d)

Question 4

(a) Briefly describe the three regions of BJT operation and the corresponding application. (3 marks)

(b) For the circuit shown in Figure 4(b), find I_C and V_{CE}. Next, sketch the load line with proper labeling. (8 marks)

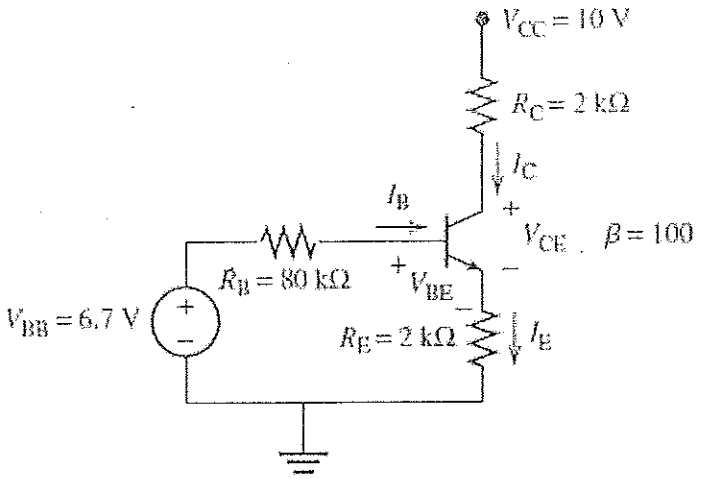


Figure 4(b)

(c) Given the transistor inverter of Figure Q4(c) to operate with a saturation current of 8 mA using a transistor with a β=100. Use a level of I_B equal to 120% of I_{Bmax} calculate the value of R_C and R_B. (5 marks)

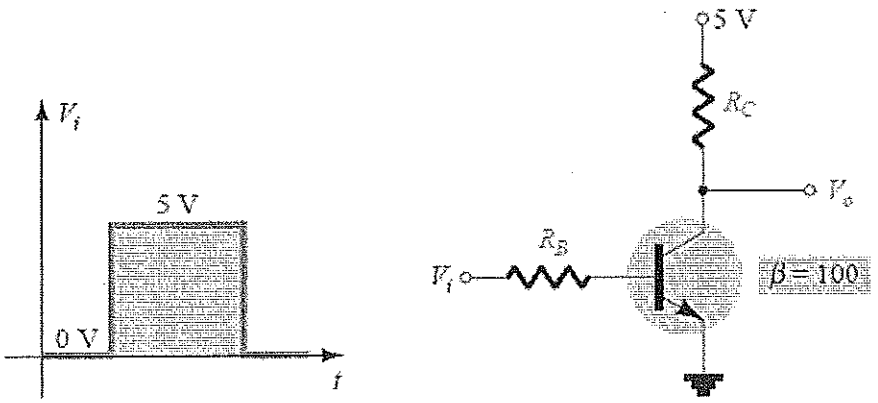


Figure Q4(c)

(d) Determine how much the Q-point (I_E,V_{CE}) for the circuit in Figure Q4 (d) . Assume V_{BE} = 0.7 V and β = 100. Given Vcc = 12 V, R_1 = 30 KΩ, R_2 = 10 KΩ, R_C = 1 KΩ and R_E=0.5 kΩ. (9 marks)

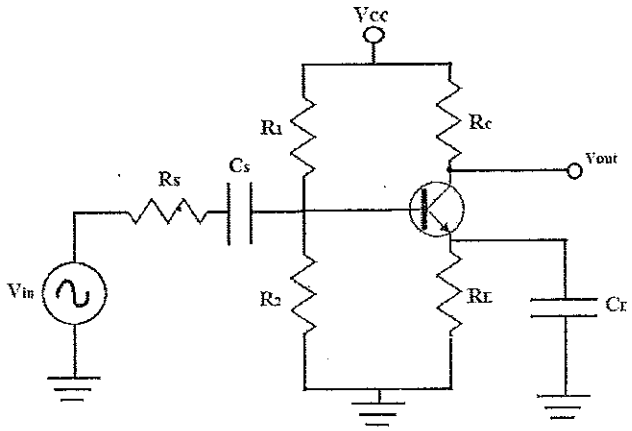


Figure Q4 (d)

Question 5

(a) What are the major differences between the collector characteristics of a BJT transistor and the drain characteristics of a JFET transistor? Compare the units of each axis and the controlling variable

(4 marks)

(b) The following graph in Figure Q5 (b) were obtained during an experiment on an N-channel FET. A FET operates with a drain current of 50 mA and a gate-source bias of -2 V.The forward transfer conductance, $g_{fs} = 0.025$ S. Determine the change in drain current if the bias voltage increases to -2.5 V.

(5 marks)

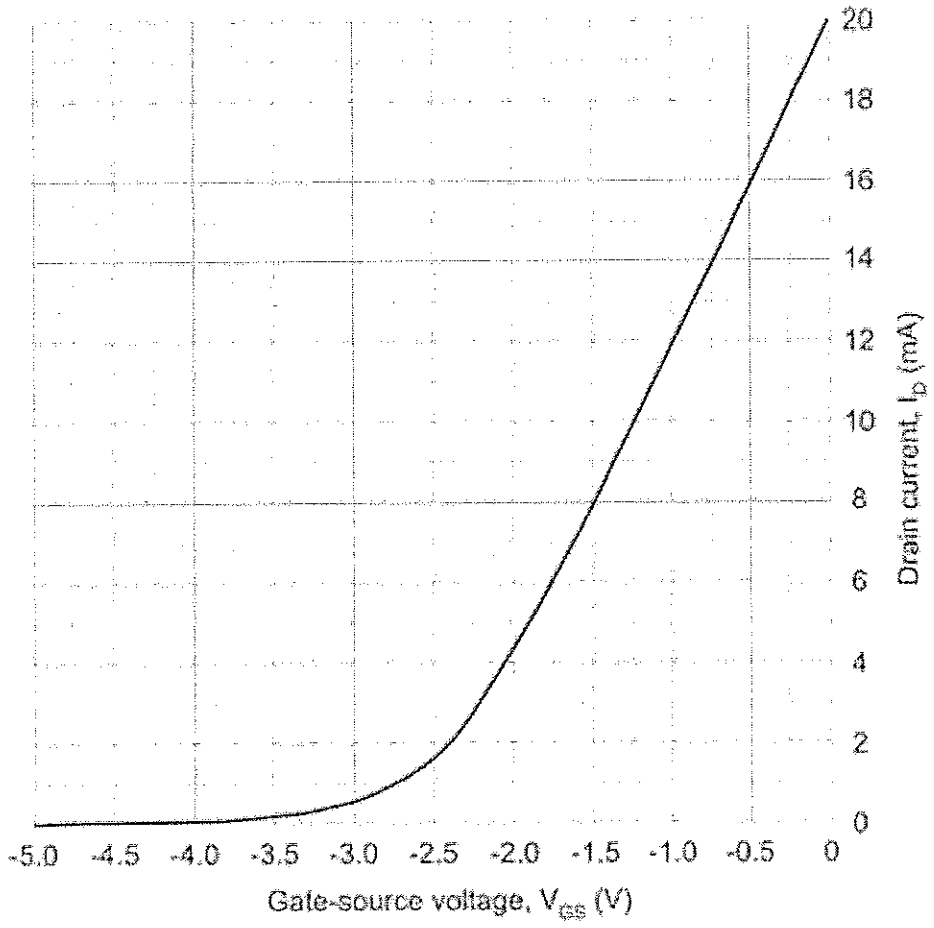


Figure Q5 (b)

(c) For the JFET biasing network in Figure Q5(c), determine

(i) I_{DQ} and V_{GSQ}.

(8 marks)

(ii) V_{DS} and V_{DG}.

(4 marks)

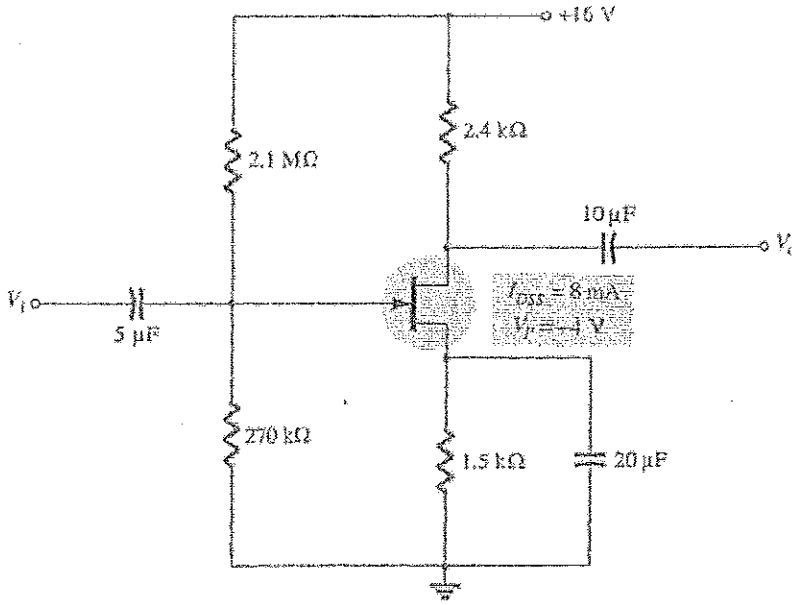


Figure Q5(c)

(d) Determine V_{DS} for the E-MOSFET circuit in Figure Q5 (d). Assume this particular MOSFET has minimum values of $I_{D(on)} = 200$ mA at $V_{GS} = 4$ V and $V_{GS(th)} = 2$ V.

(4 marks)

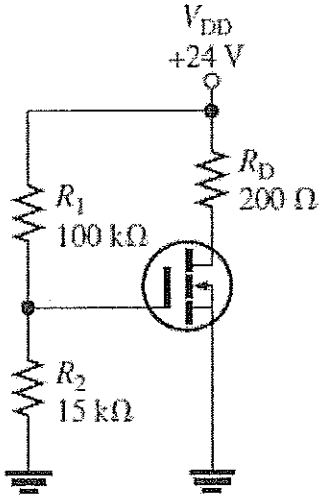


Figure Q5(d)

Question 6

(a) Calculate the voltage drops across all components in the circuit in Figure Q6 (a), expressing them in complex (polar) form with magnitudes and phase angles each. (6 marks)

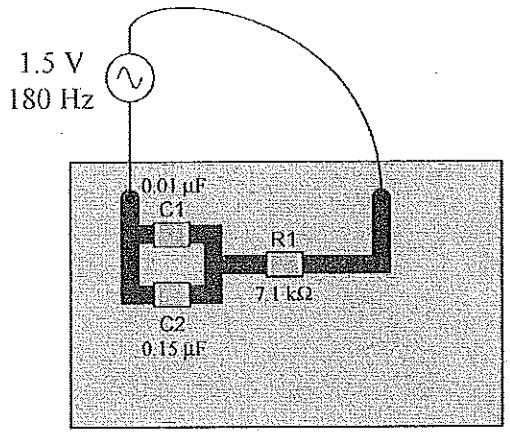


Figure Q6 (a)

(b) Determine the total current and all component currents in the circuit in Figure Q6 (b). Also, calculate the phase angle (Θ) between voltage and current in this circuit. (6 marks)
Given:
L1 = 1.2 H
L2 = 650 mH
R1 = 33 kΩ
R2 = 27 kΩ
Vsupply = 19.7 V_{RMS}
Frequency supply = 4.5 kHz

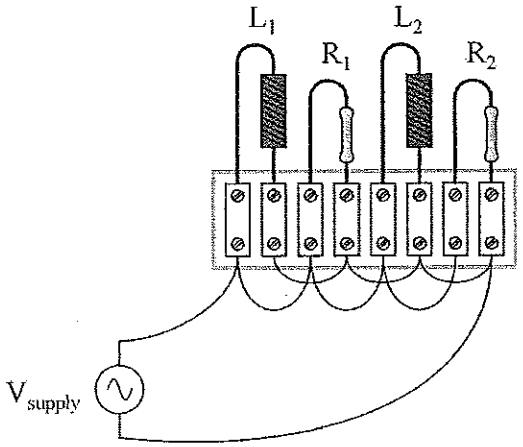


Figure Q6 (b)

(c) For the following circuits in Figure Q6(c) (i) & (ii), assume that R = 100Ω and Vin(t) = 8sin(t) and that the diodes have 1 a threshold voltage of 0.7 V . Plot Vout(t). (9 marks)

(i)

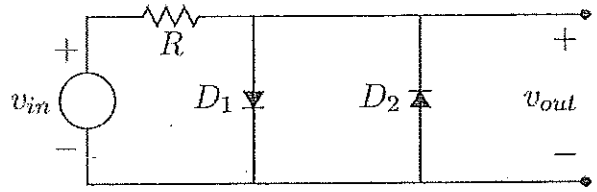


Figure Q6(c) (i)

(ii)

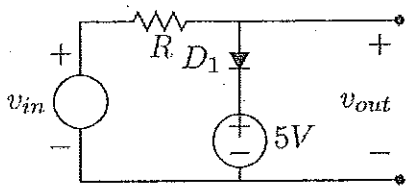


Figure Q6(c) (ii)

(d) Determine both the wave shape and amplitude of the AC signal measured by the oscilloscope at the output of the circuit in Figure Q6 (d). The diodes are model 1N4001, each. The resistor's color code is Brown, Black, Orange and Silver. (4 marks)

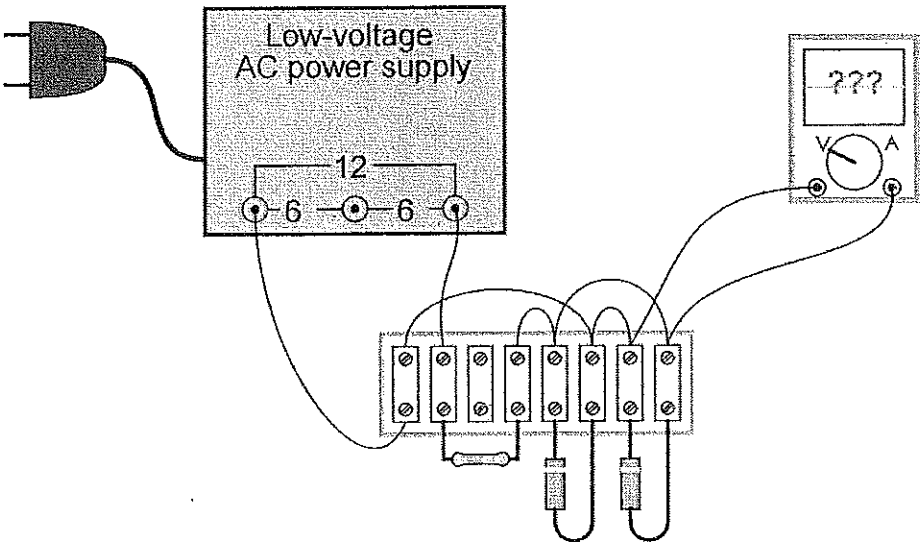


Figure Q6 (d)

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