



INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES*

FINAL
Examination Paper

(COVER PAGE)

Session : August 2017

Programme : Diploma in Electrical and Electronic Engineering (DEEI)

Course : EEE 1105: Circuit Theory & Electronic Devices

Date of Examination : 11 December 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.

IMPORTANT NOTE : THIS PAPER SHOULD NOT BE TAKEN OUT OF THE EXAMINATION HALL

Materials permitted :
Non-Programmable Scientific Calculator

Materials provided :
Graph Paper (A4)

Examiner(s) : Mr. Steven Khoo Boo Tap

Moderator : Mr. 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 & ELECTRONIC DEVICES
 FINAL EXAMINATION: AUGUST 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 current passing through each branch using Nodal analysis for Figure 1(a). Given that $G_1 = 10 \text{ m}\Omega$, $G_2 = 100 \text{ }\mu\Omega$, $G_3 = 5 \text{ m}\Omega$, $G_4 = 100 \text{ }\mu\Omega$ and $G_5 = 1 \text{ m}\Omega$. Indicate the reference node. (15 marks)

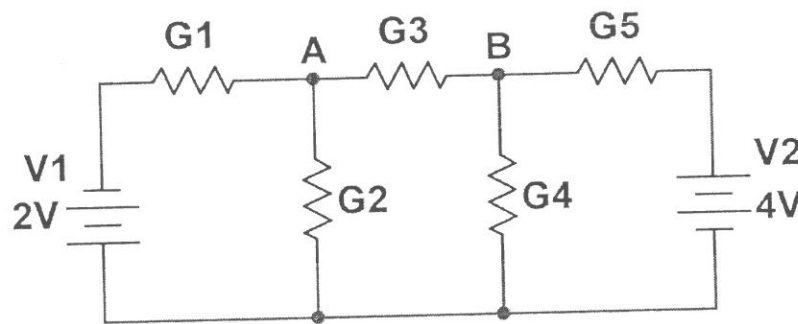


Figure 1(a)

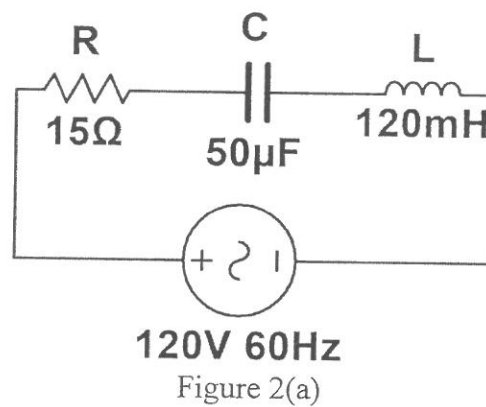
- (b) Calculate the resistance and the inductance or capacitance in series for each of the following impedances:

Assume that the frequency is 60 Hz.

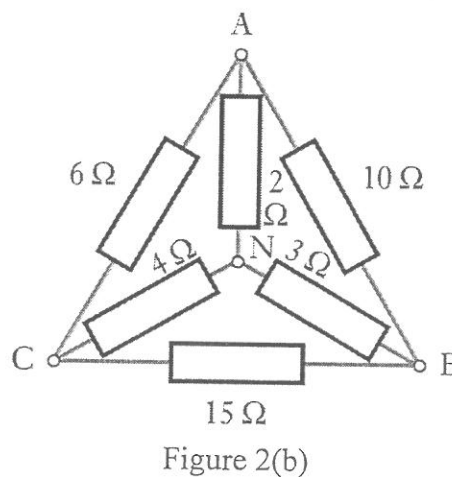
- (i) $j45 \Omega$. (2 marks)
- (ii) $10 - j80 \Omega$. (2 marks)
- (iii) $29 \angle -60^\circ \Omega$. (3 marks)
- (iv) $167 \angle 30^\circ \Omega$. (3 marks)

Question 2

- (a) A circuit as shown in Figure 2(a) having a resistance of $15\ \Omega$, an inductance of $120\ \text{mH}$ and a capacitance of $50\ \mu\text{F}$ in series, is connected across a $120\ \text{V}$, $60\ \text{Hz}$ supply. Calculate:
- (i) the impedance; (4 marks)
 - (ii) the current; (2 marks)
 - (iii) the voltages across R, C and L; (6 marks)
 - (iv) the phase difference between the current and the supply voltage. (3 marks)



- (b) A network is arranged as in Figure 2(b). Calculate the equivalent resistance between node A and B. (10 marks)



Question 3

- (a) For the series diode configuration of Figure 3(a)(i), employing the diode characteristics of Figure 3(a)(ii). Determine the V_{DQ} , I_{DQ} and V_R . Sketch the load line graph of I_D (mA) versus V_D (V). (9 marks)

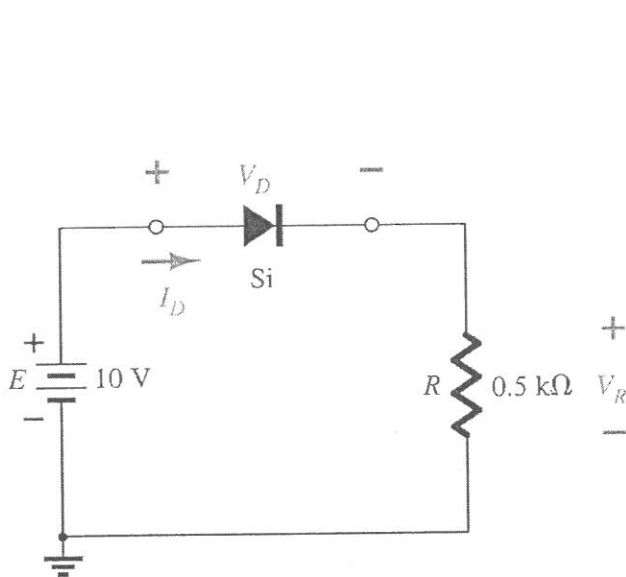


Figure 3(a)(i)

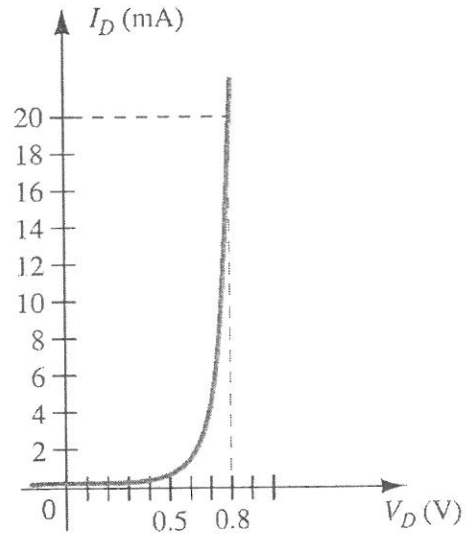


Figure 3(a)(ii)

- (b) Determine V_o , I_1 , I_{D_1} and I_{D_2} for the parallel diode configuration of Figure 3(b). Explain the purpose of why an additional diode, D_2 is place in parallel for Figure 3(b). Assume that both diodes are having similar characteristics. (7 marks)

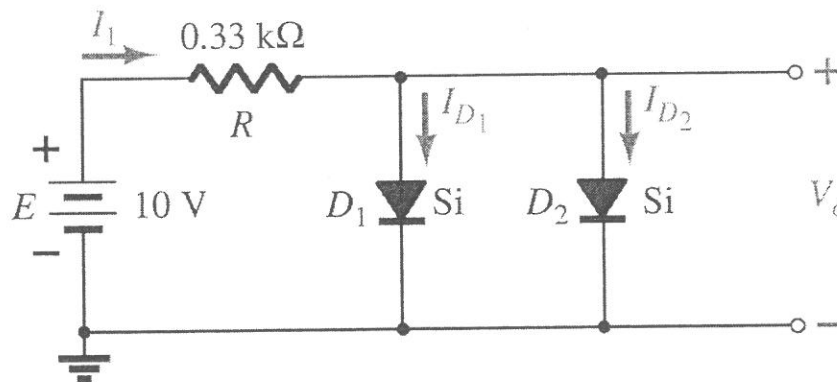


Figure 3(b)

- (c) Referring to Figure 3(c), determine the range of values of V_i that will maintain the Zener diode in the "ON" state. Also, sketch the graph of V_L versus V_i .

(9 marks)

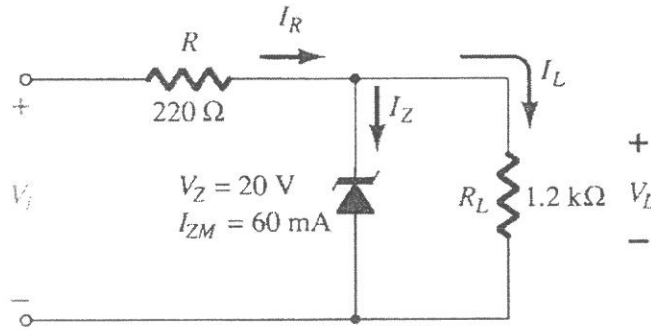
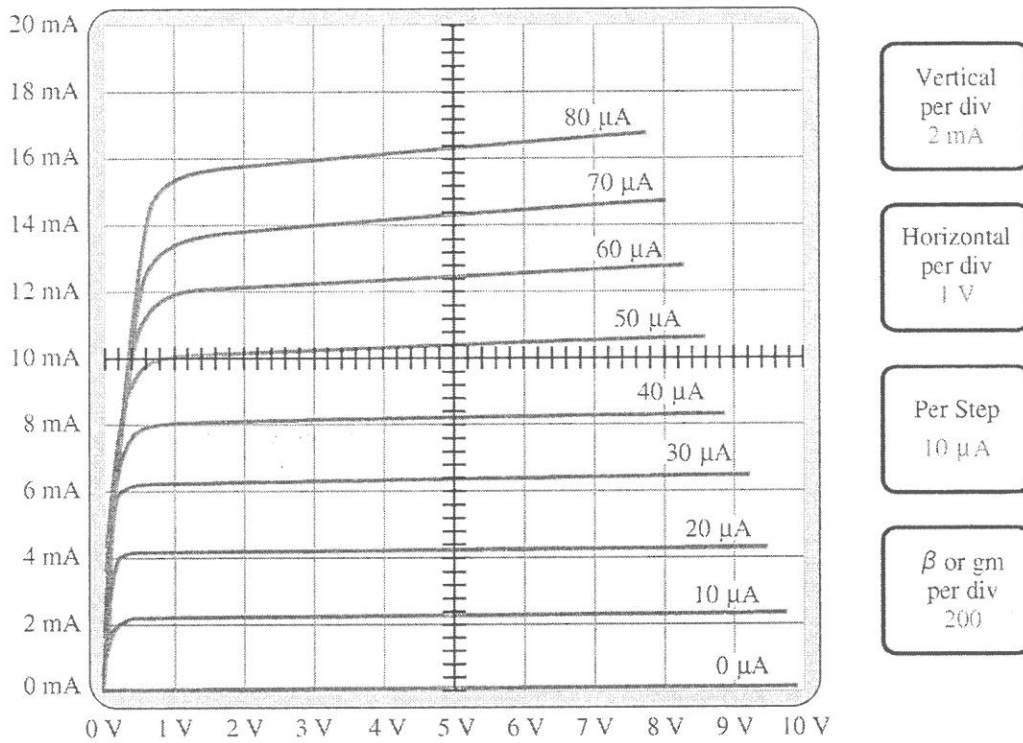


Figure 3(c)

Question 4

- (a) Determine β_{ac} for the transistor characteristics of Figure 4(a) at $I_C = 7 \text{ mA}$ and $V_{CE} = 5 \text{ V}$.



- Vertical per div 2 mA
- Horizontal per div 1 V
- Per Step 10 μA
- β or gm per div 200

Figure 4(a)

(4 marks)

- (b) For the circuit shown in Figure 4(b), find I and V_{CE} . Next, sketch the load line with proper labeling. (7 marks)

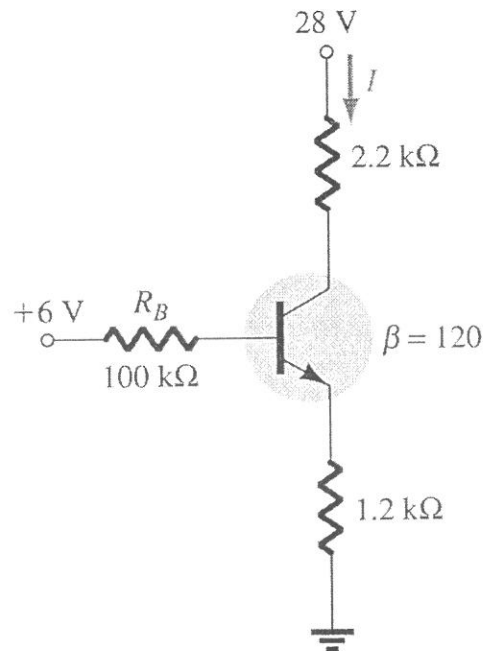


Figure 4(b)

- (c) Determine R_B and R_C for the transistor inverter of Figure 4(c) if $I_{C_{sat}} = 10 \text{ mA}$. Use a standard resistor values for R_B and R_C . Also, sketch the output waveform of Figure 4(c). (6 marks)

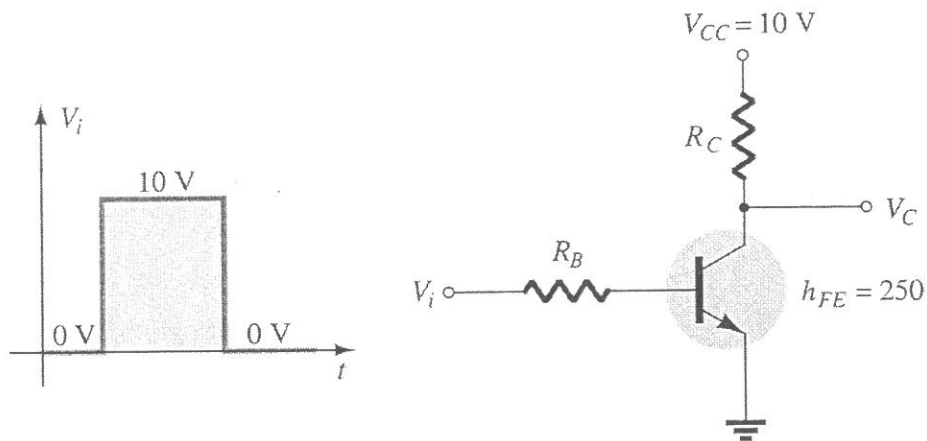


Figure 4(c)

- (d) Determine the dc bias voltage V_{CE} and the current I_C for the circuit in Figure 4(d). Assume $V_{BE} = 0.7 \text{ V}$ and $\beta = 100$. If β is reduced to 50, compare and comment on the new I_{CQ} and V_{CEQ} . (8 marks)

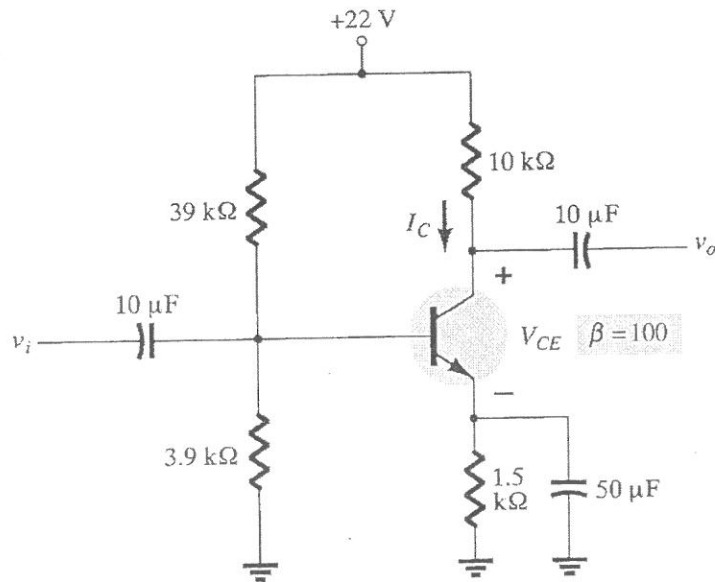


Figure 4(d)

Question 5

- (a) Three branches, possessing a resistance of $0.05 \text{ k}\Omega$, an inductance of 150 mH and a capacitance of 0.1 mF respectively, are connected in parallel across a 100 V , 50 Hz supply. Calculate:
- (i) The current in each branch. (3 marks)
 - (ii) The supply current. (2 marks)
 - (iii) The phase angle between the supply current and the supply voltage. (3 marks)

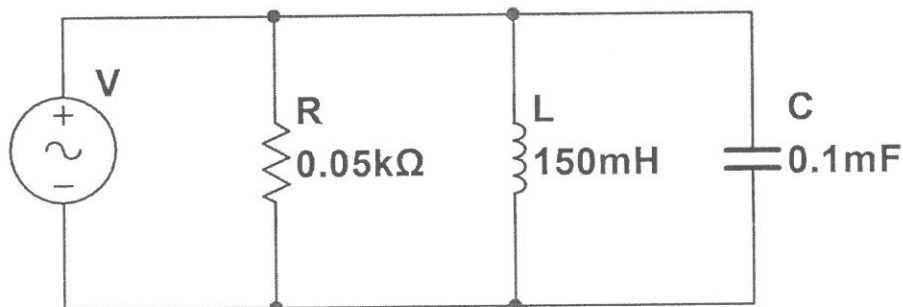


Figure 5(a)

- (b) By using Mathematical approach, determine V_{GSQ} and I_{DQ} for the circuit of Figure 5(b). Show how Graphical approach can be used to estimate the I_{DQ} with resulting Shockley curve. (7 marks)

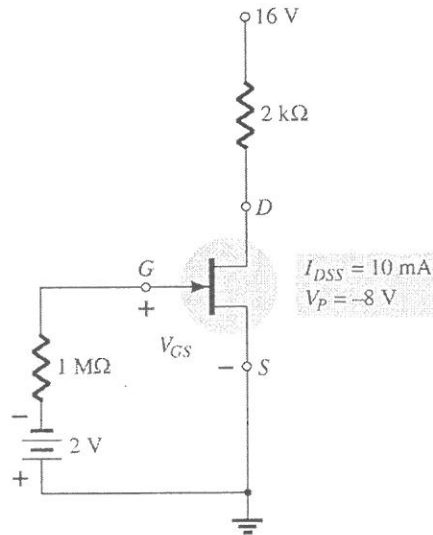


Figure 5(b)

- (c) For the JFET biasing network in Figure 5(c), determine:

- (i) The I_{DQ} and V_{GSQ} . (6 marks)
- (ii) The V_{DS} and V_{DG} . (4 marks)

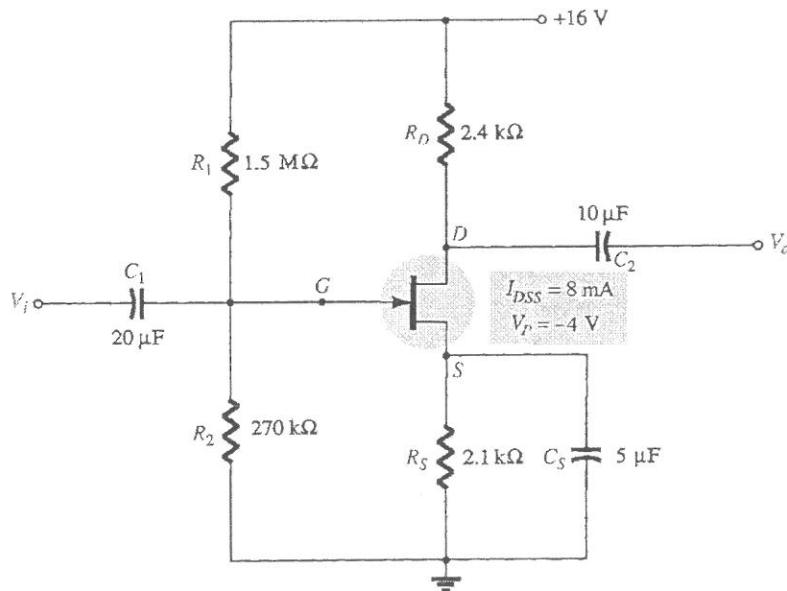


Figure 5(c)

Question 6

- (a) Calculate the voltage drops across all components in the circuit in Figure 6(a), expressing them in complex (polar) form with magnitudes and phase angles each. Also, draw the equivalent electrical circuit diagram for Figure 6(a).

(7 marks)

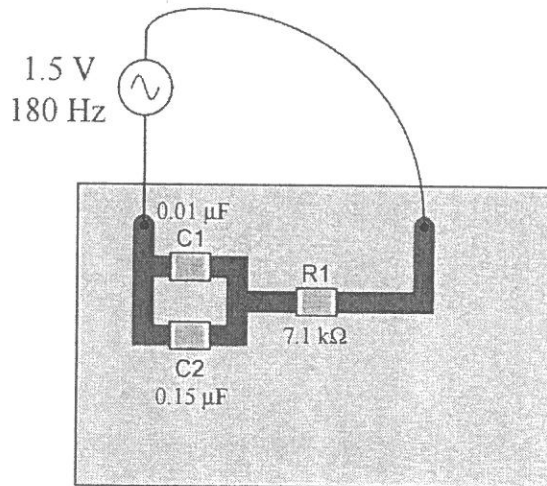


Figure 6(a)

- (b) Determine the total current and all component currents in the circuit in Figure 6(b). Calculate the phase angle (θ) between voltage and current in this circuit. Also, draw the equivalent electrical circuit diagram for Figure 6(b).

Given:

$L_1 = 1.2 \text{ H}$, $L_2 = 650 \text{ mH}$, $R_1 = 33 \text{ k}\Omega$, $R_2 = 27 \text{ k}\Omega$, $V_{\text{supply}} = 19.7 \text{ V}_{\text{RMS}}$, Frequency supply = 4.5 kHz.

(8 marks)

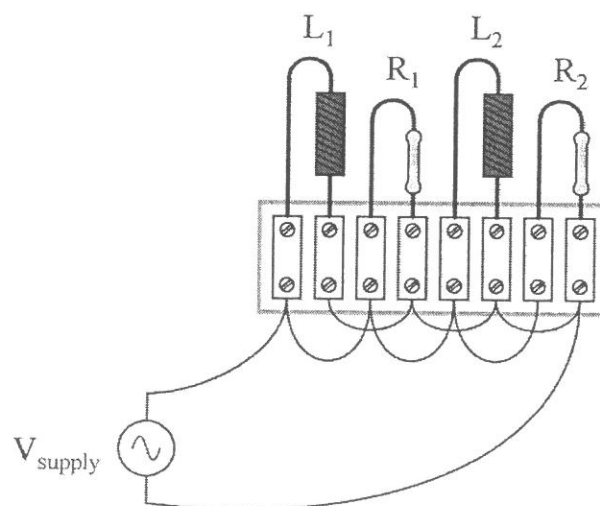


Figure 6(b)

- (c) Calculate the current in the $5\ \Omega$ resistor in the network shown in Figure 6(c) using Norton's theorem. (6 marks)

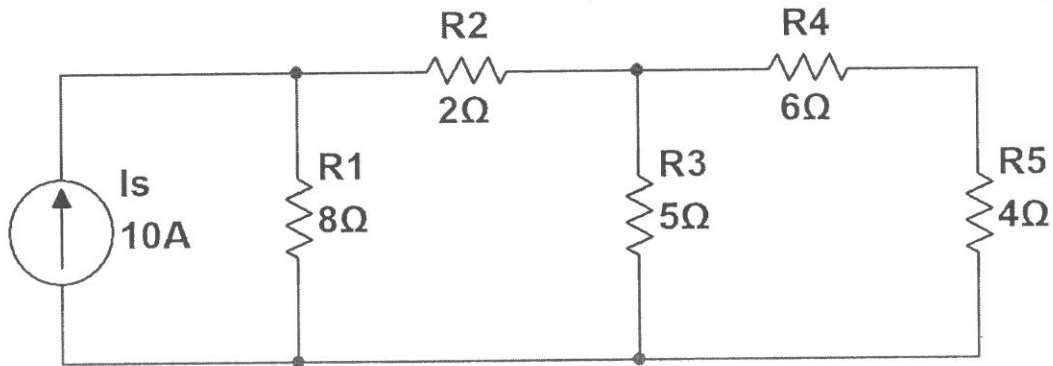
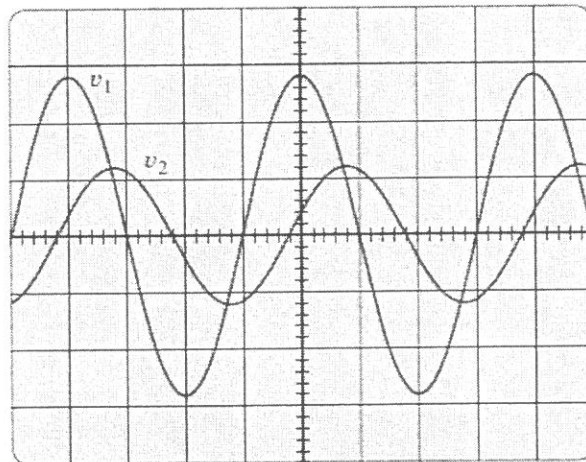


Figure 6(c)

- (d) For the waveforms shown by the oscilloscope in Figure 6(d), determine the phase relationship between the waveforms, and indicate which one leads or lags. (4 marks)



Vertical sensitivity = $0.5\ \text{V/div}$.
Horizontal sensitivity = $0.2\ \text{ms/div}$.

Figure 6(d)

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