UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	ELECTRONIC DEVICES AND CIRCUITS II
COURSE CODE	:	BNR 25903
PROGRAMME	:	BNE
EXAMINATION DATE	:	JUNE 2017
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) Analyze the range of the output voltage in the circuit of **Figure Q1(a)** if the input, V_i is varied from 2 V to 8 V.

(4 marks)

(b) Calculate the input voltage that must be applied to the input of **Figure Q1(b)** to produce an output of 2.4 V.

(4 marks)

(c) Analyze the output voltage developed by the circuit of **Figure Q1(c)** for R_f = 130 kΩ and R_f = 980 kΩ. Which R_f value is suitable for summing amplifier?

(6 marks)

(d) Analyze the total offset voltage for the circuit of **Figure Q1(d)** for an op-amp with specified values of input offset voltage V_{IO} = 12 mV and input offset current I_{IO} = 110 nA.

(5 marks)

(e) Calculate the output voltage for the circuit of **Figure Q1(e)**.

(6 marks)

Q2 (a) Show the connection of an LM124 quad op-amp as a three-stage amplifier with gains of +16, -28, and -31. Use a 420-kΩ feedback resistor for all stages. Analyze the output voltage results for V_i = 120 mV.

(8 marks)

(b) Show the connection (including pin information) of two LM358 stages connected as unity-gain amplifiers to provide the same output.

(3 marks)

(c) Calculate the cutoff frequency of a first-order low-pass filter for R_1 = 3.2 kΩ and C_1 = 0.0004 mF.

(2 marks)

(d) Calculate the cutoff frequency of a second-order high-pass filter for R_1 = R_2 = 2.1 kΩ, C_1 = C_2 = 0.00005 mF, and R_G = 15 kΩ, R_F = 70 kΩ.

(3 marks)

(e) Analyze the circuit of **Figure Q2(e)**, calculate I_L .

(3 marks)

(f) Analyze the bandpass filter circuit in **Figure Q2(f)**. Find the lower and upper cutoff frequencies.

(6 marks)

Q3 (a) Differentiate between class A and B power amplifier.

(4 marks)

(b) Differentiate between class A and AB power amplifier.

(4 marks)

(c) Define the characteristics of class D power amplifier.

(3 marks)

(d) For a class B amplifier with $V_{CC} = 25$ V driving an 8 Ω load, determine:

(i) Maximum input power.

(ii) Maximum output power.

(iii) Maximum circuit efficiency.

(6 marks)

(e) The circuit of **Figure Q3(e)** has an input signal results in a base current of 5 mA rms. Calculate the input and output power. Analyze the maximum output power can be delivered by the circuit if R_B is changed to 5 kΩ?

(8 marks)

Q4 (a) Draw the output waveform for the circuit of **Figure Q4(a)**.

(2 marks)

(b) Sketch a five-stage ladder network using 12 kΩ and 45 kΩ resistors. For a reference voltage of 21 V, analyze the output voltage for an input of 11010 to the circuit.

(6 marks)

(c) Draw the circuit of a one-shot using a 555 timer to provide one time period of 40 μs. Analyze value of C needed if $R_A = 9.5$ kΩ.

(7 marks)

(d) Sketch the input and output waveforms for a one-shot using a 555 timer triggered by a 15 kHz clock for $R_A = 5.6$ kΩ and $C = 12$ nF.

(5 marks)

(e) Calculate the center frequency of a VCO using a 566 IC as shown in **Figure Q4(e)** for $R_1 = 7.4$ kΩ, $R_2 = 2.8$ kΩ, $R_3 = 33$ kΩ, and $C_1 = 0.0015$ μF.

(5 marks)

- END OF QUESTIONS -

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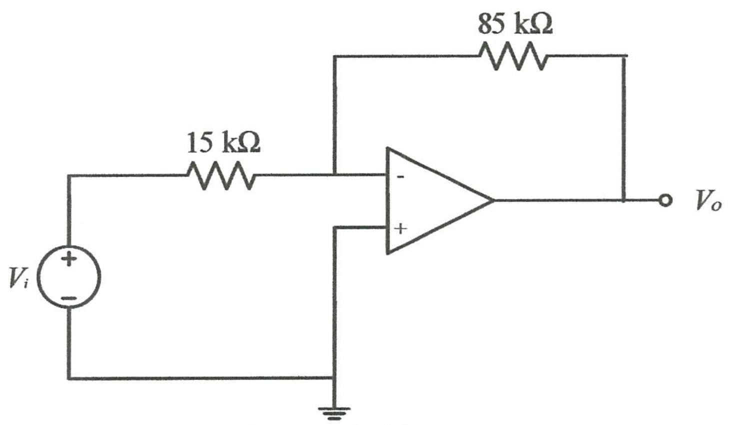

Figure Q1(a)

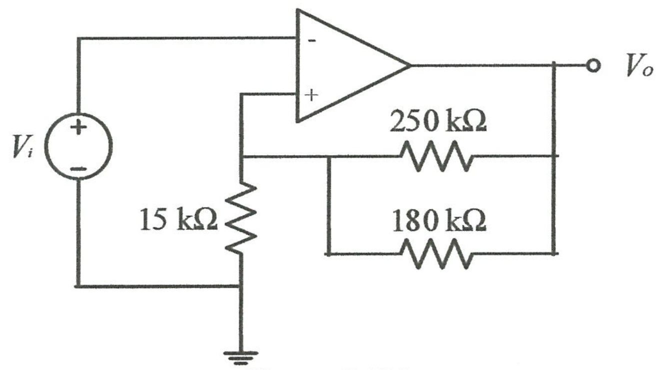

Figure Q1(b)

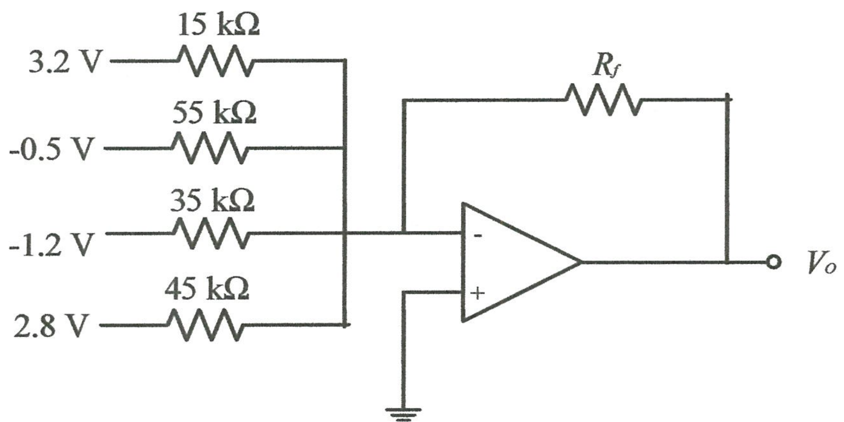

Figure Q1(c)

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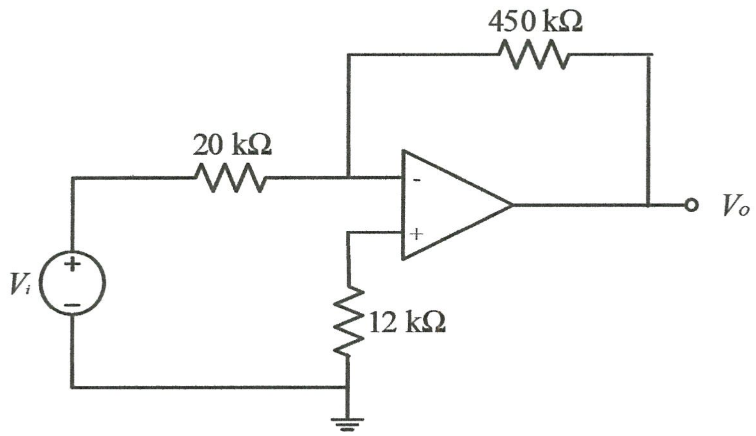

Figure Q1(d)

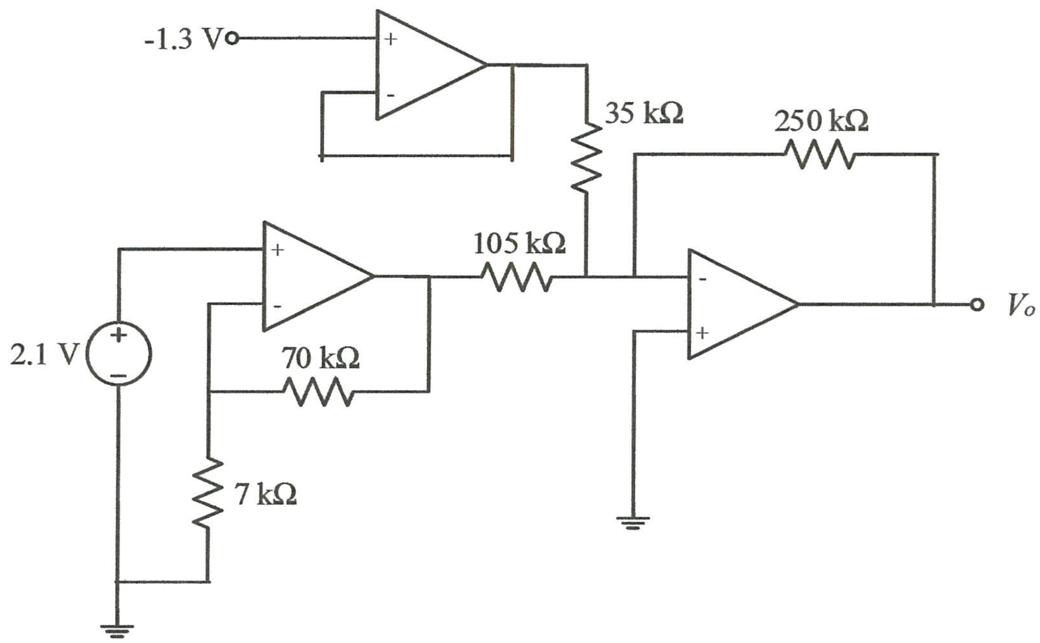

Figure Q1(e)

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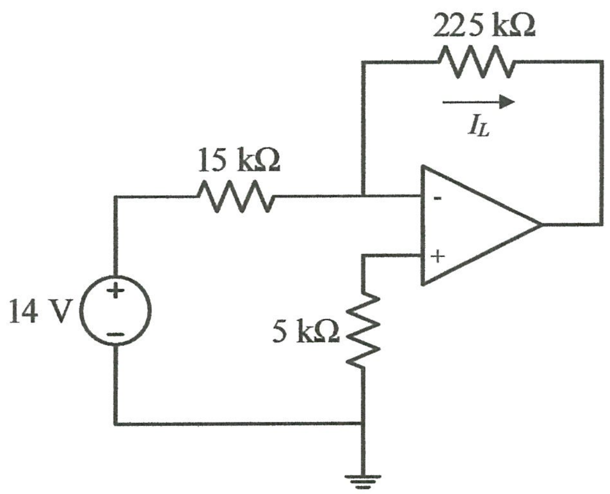

Figure Q2(e)

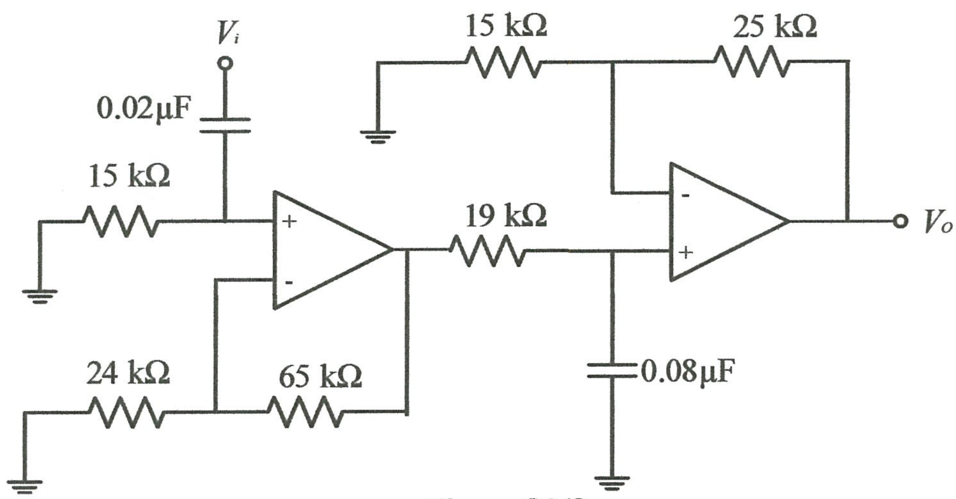

Figure Q2(f)

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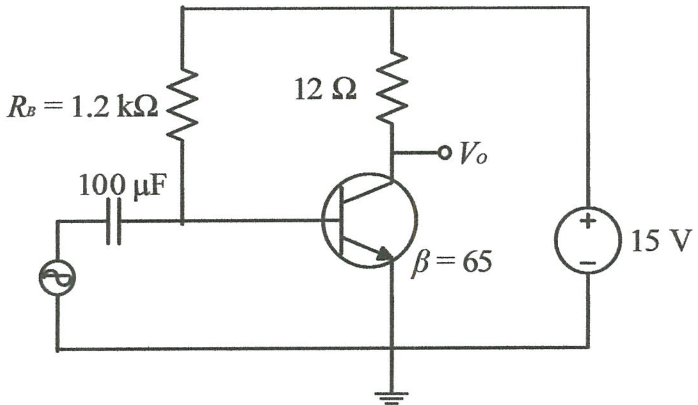

Figure Q3(e)

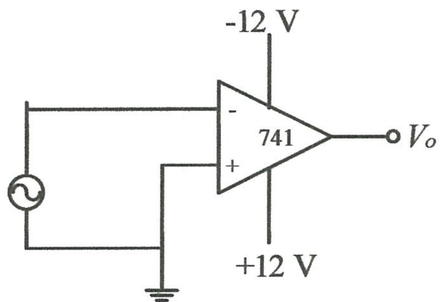

Figure Q4(a)

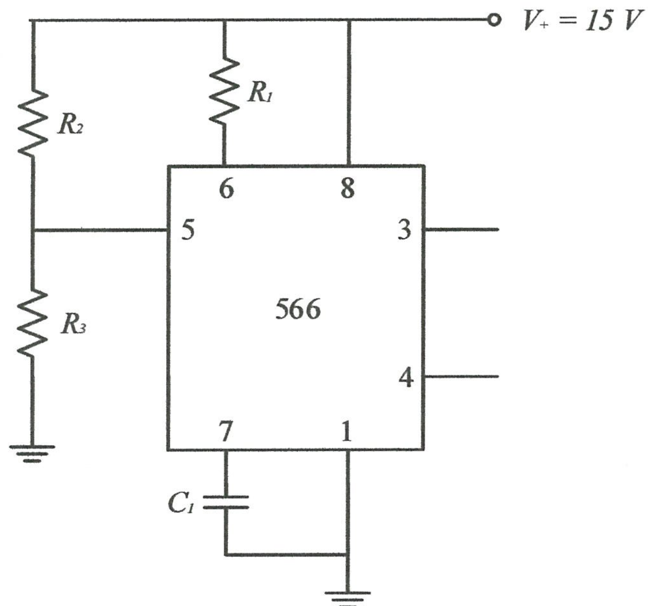

Figure Q4(e)

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APPENDIX 1

$$\text{CMRR} = 20\log_{10}\frac{A_d}{A_c}$$

$$\frac{V_o}{V_i} = -\frac{R_f}{R_1}$$

$$\frac{V_o}{V_i} = 1 + \frac{R_f}{R_1}$$

$$V_o = V_1$$

$$V_o = -\left(\frac{R_f}{R_1}V_1 + \frac{R_f}{R_2}V_2 + \frac{R_f}{R_3}V_3\right)$$

$$v_o(t) = -\frac{1}{RC}\int v_1(t)\,dt$$

$$\text{Slew rate (SR)} = \frac{\Delta V_o}{\Delta t} \quad \text{V}/\mu\text{s}$$

$$A = -\frac{R_f}{R_1}$$

$$A = 1 + \frac{R_f}{R_1}$$

$$A = -\left[\frac{R_f}{R_1}V_1 + \frac{R_f}{R_2}V_2 + \frac{R_f}{R_3}V_3\right]$$

$$V_o = V_1$$

$$f_{OH} = \frac{1}{2\pi R_1 C_1}$$

$$f_{OL} = \frac{1}{2\pi R_1 C_1}$$

$$P_i(\text{dc}) = V_{CC} I_{CQ}$$

$$P_o(\text{ac}) = V_{CE}(\text{rms}) I_C(\text{rms}) = I_C^2(\text{rms}) R_C = \frac{V_C^2(\text{rms})}{R_C}$$

$$P_o(\text{ac}) = \frac{V_{CE}(\text{p}) I_C(\text{p})}{2} = \frac{I_C^2(\text{p})}{2R_C} = \frac{V_{CE}^2(\text{p})}{2R_C}$$

$$P_o(\text{ac}) = \frac{V_{CE}(\text{p-p}) I_C(\text{p-p})}{8} = \frac{I_C^2(\text{p-p})}{8}R_C = \frac{V_{CE}^2(\text{p-p})}{8R_C}$$

$$\%\,\eta = \frac{P_o(\text{ac})}{P_i(\text{dc})} \times 100\%$$

$$\frac{V_2}{V_1} = \frac{N_2}{N_1}$$

$$\frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$I_{\text{dc}} = \frac{2}{\pi} I(\text{p})$$

$$P_i(\text{dc}) = V_{CC}\left(\frac{2}{\pi} I(\text{p})\right)$$

$$P_o(\text{ac}) = \frac{V_L^2(\text{rms})}{R_L}$$

$$\%\,D_n = \frac{|A_n|}{|A_1|} \times 100\%$$

$$V_o(\text{offset}) = V_{IO}\frac{R_1 + R_f}{R_1}$$

$$V_o = I_{IO} R_f$$