



MDK

UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI, GHANA

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING

Level 300: First Semester Examinations 2019/2020

Bachelor of Science (Computer Engineering, Electrical & Electronic Engineering)

ELNG 303: LINEAR ELECTRONIC CIRCUITS

DECEMBER, 2019

Time: 2½ hours

INSTRUCTIONS: ANSWER ALL FOUR QUESTIONS

Question One [3+(2+4)+4=13]

- a) With the aid of diagrams, briefly describe the process of photolithography used in the fabrication of monolithic ICs.
- b) A circuit is built around a bi-polar NPN transistor. The base network has a diode and a capacitor in series while the collector is connected to a power supply through a resistor. If the emitter is connected to ground:
- Draw the circuit
 - Provide all the masking layout of the circuit
- c) Fig1.1 shows a p-diffusion resistor fabricated with a sheet resistance of 120 Ohm per square. The corners and the pads are estimated to have 0.6 of the value of a regular sheet resistance. Find the value of the resulting resistor.

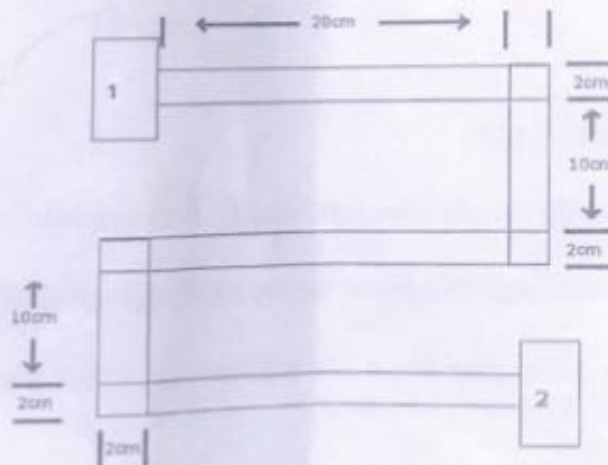


Fig1.1

Question Two [2+4+6+6=18]

- Mention the characteristics of an ideal op-amp.
- Draw a shunt regulator and clearly show the four main elements. Derive an expression for the output voltage.
- A differential amplifier has an output voltage given by $V_o = 9V_1 - 10V_2$. The two inputs are $V_1 = 10\text{ mV}$ and $V_2 = 20\text{ mV}$. Determine common mode input voltage, common mode gain and the differential gain.
- In Op-Amp circuit of Fig. 2.1, find V_o in terms of V_1 and V_2 assume the ideal op amp model. Find an expression for V_o . If $V_1 = 1.5\text{V}$ and $V_2 = 3.0\text{V}$, find V_o for $R_1 = 1\text{k}\Omega$ and $R_2 = 2\text{k}\Omega$

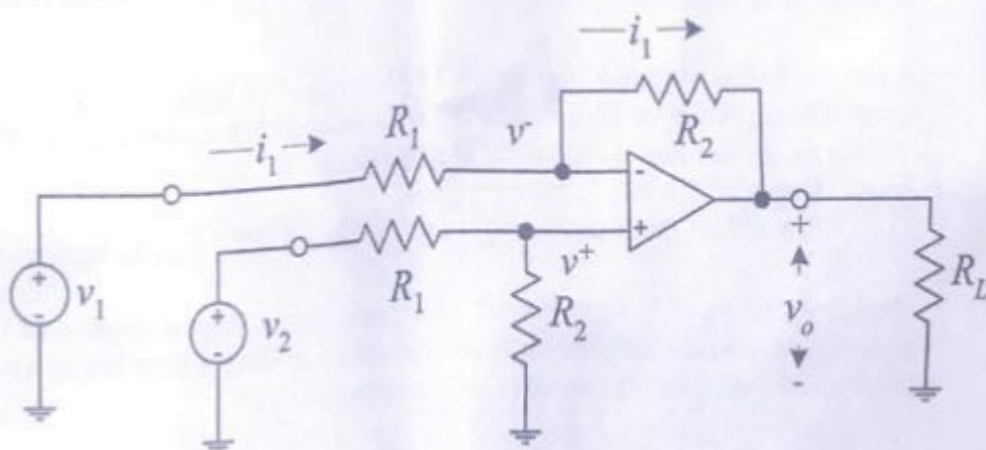


Fig 2.1

Question Three [2+4+(2x3)=12]

- State and explain the various classifications of power amplifiers.
- For a class B power amplifier, show that the maximum efficiency is 78.5%.
- For a class B amplifier providing a 20V peak-to-peak signal to an 8Ω speaker and a power supply of $V_{cc} = 15\text{V}$, determine:
 - Input power
 - Output power
 - Circuit efficiency

Question Four [4+4+(3x3) = 17]

Consider the common-emitter BJT amplifier circuit shown in Figure 4.1. Take $\beta_1 = \beta_2 = 200$, $V_{BE} = 0.7V$ and thermal voltage as $26V$. Answer the following questions.

- Determine the emitter current I_{E2} , I_{E1} and hence r_{e2} and r_{e1}
- Draw the AC equivalent circuit and determine:
 - Input impedance, Z_1 , Z_2 and Z_{in}
 - Gain of the transistor, A_{v2} and A_{v1}
 - Output voltage gain with signal, A_{vs}

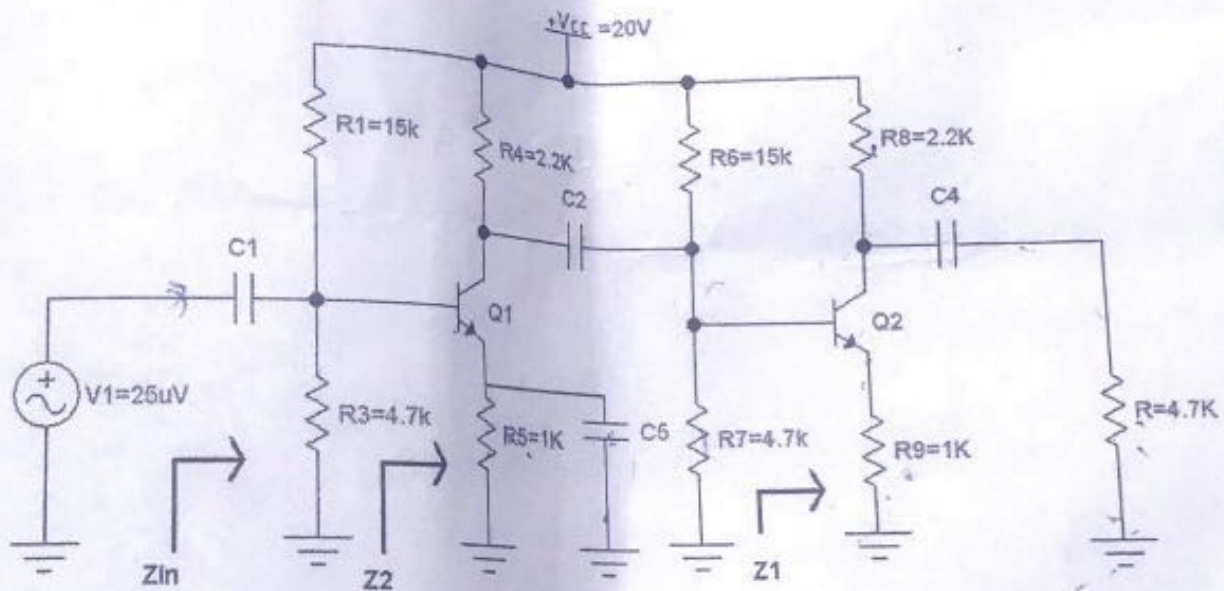


Fig. 4.1