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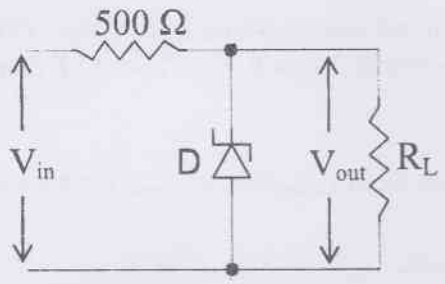
RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Second Year – Semester I Examination – Oct/ Nov 2015

PHY2103–Electronics

Answer **All** Questions. Time allowed: $1\frac{1}{2}$ **hours**

1. The Zener diode in the circuit has following characteristics: 7.0 V rating at 10 mA, r_z = 20 Ω and I_{zk} = 0.2 mA.



a. Find Vzo of the Zener diode.

b. Find V_{out} with no load (no R_L) and V_{in} = 10 V.

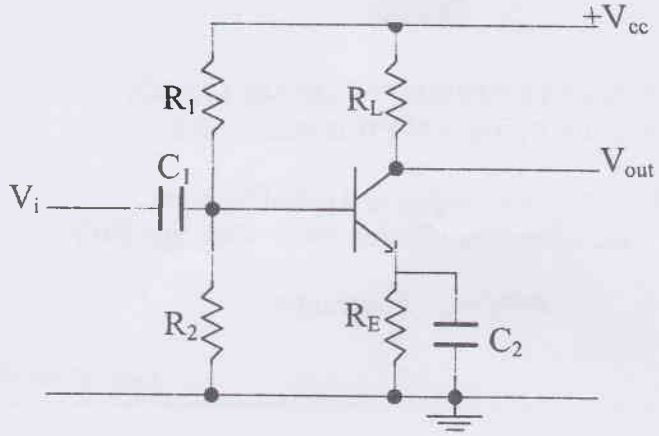
c. Find the change in output voltage (V_{out}), if the input voltage (V_{in}) fluctuate by ± 1 V.

d. The Line Regulation of a regulator circuit is defined by the ratio of the change in output voltage to the change in input voltage ($\frac{\Delta V_{out}}{\Delta V_{in}}$). Find the Line Regulation of the above circuit.

e. Find the change in output voltage (V_{out}), resulting from connecting a load of 2 kΩ (R_L = 2 kΩ) to the circuit.

(35 Marks)

2. Following circuit diagram shows a common-emitter configuration of an **npn** transistor.



a. Using Thevenin's theorem simplify the above circuit to have one base resistor ($\mathbf{R_{TH}}$) and one base power source ($\mathbf{V_{TH}}$). Derive equations for $\mathbf{R_{TH}}$ and $\mathbf{V_{TH}}$.

b. Derive equations for open circuit voltage ($\mathbf{V_{CE(max)}}$) and short circuit current ($\mathbf{I_{C(max)}}$). If $R_1 = R_2 = 150\ \Omega$, $R_L = R_E = 500\ \Omega$, $V_{BE} = 0.7\ V$, $V_{CC} = 12\ V$ *and* $\beta = 100$, calculate the $\mathbf{I_{C(max)}}$ and $\mathbf{V_{CE(max)}}$.

c. Sketch the load line and mark the $\mathbf{I_{CE(max)}}$ and $\mathbf{V_{CE(max)}}$ for the above circuit.

d. Find the **Q-point** of the circuit.

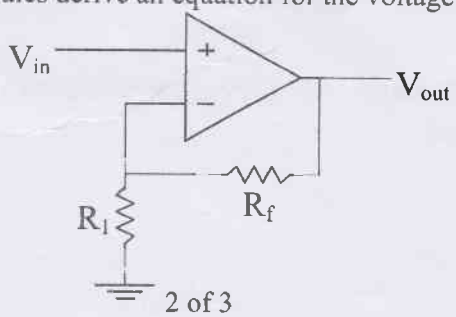
e. Show that the **Q – point** of the above circuit is independent of the change in β.

(35 Marks)

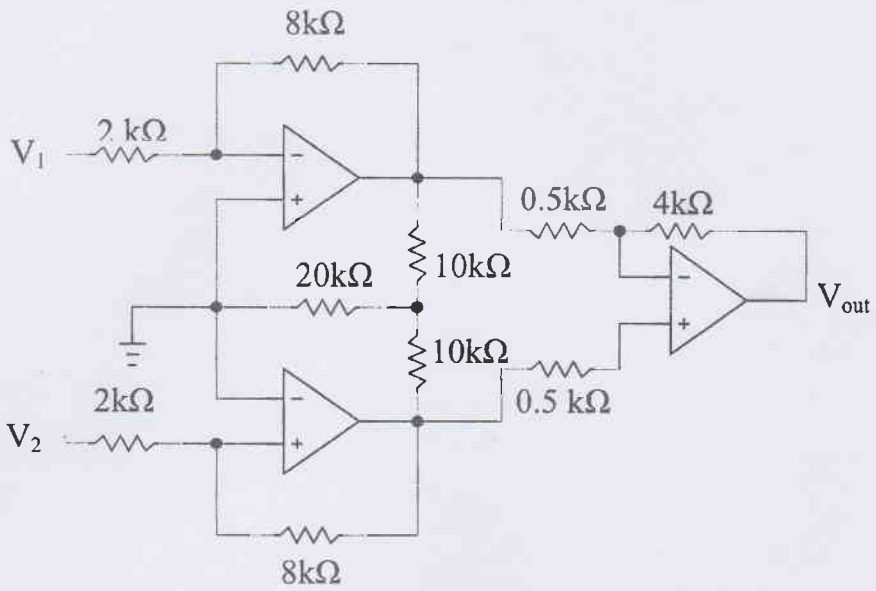
3. Operational Amplifiers (Op-Amp) are a class of high gain DC coupled amplifiers with two differential inputs and one output terminal.

a. State two golden rules of an ideal Op Amp.

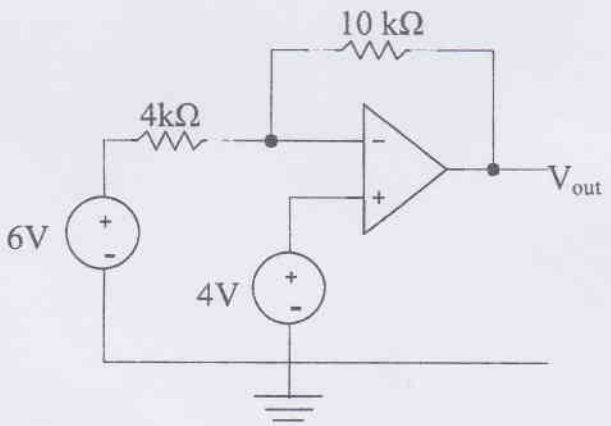
b. Using above mentioned rules derive an equation for the voltage gain of the following non-inverting amplifier.



c. Following circuit has two inputs (V_1 and V_2) and one output (V_{out}). Derive an equation for the output voltage (V_{out}) in terms of V_1 and V_2. (Assume all the Op-Amps are ideal)



d. Calculate the V_{out} of the following inverted circuit.



(30 Marks)