Final Semester

Course: PH209

Full marks: 50

1. a) Find the *CC h* parameters in terms of the *CE h* parameters. [Marks 3]

   b) For the circuit shown below (Figure 1), find *small signal voltage gain* (A_{vs}) *and input impedance* (in terms of A_{vs}) as seen from the source terminals. Analyze the problem ***without using Feedback concept*** **and using Millar's theorem** applied to the resistance R_1. Use h-parameter model and assume $h_{oe} = h_{re} = 0$. [Marks 5+2]

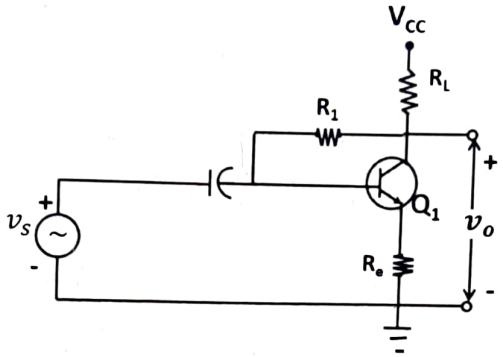

Figure 1

2. a) How negative feedback influence *voltage gain*, *input impedance* and *output impedance* of a voltage series amplifier? [Marks 1]

b) For the circuit shown below (figure 2), find the voltage gain, and input impedance seen from the source voltage terminals ***using the feedback concept*** *(without using the direct formula of voltage gain and input impedance).*

[Use h-parameter model and assume, $R_s = 0, h_{fe} = 50$, $hie = 1.1k$, $hre = hoe = 0$, and current through 4.7k resistance in the emitter of Q1 is negligible as compared to current through R_2, and both the transistors are identical [Marks 10]

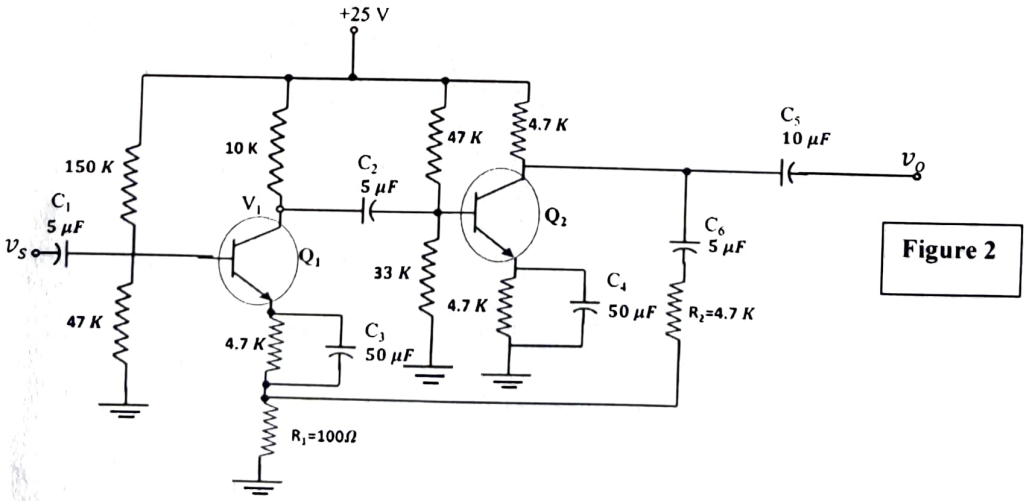

Figure 2

3. a) Briefly explain how a differential amplifier with very large CMRR can be used for amplification with minimal effect from noise signal. [Marks 3]

b) What is the *virtual ground* of an ideal OPAMP? [Marks 2]

c) Design Log and Anti-log amplifier using OPAMP (ideal), and find expression of their outputs. Using these Log and Anti-log amplifiers, draw a multiplier circuit, and show the outputs at every stage. [Marks 2+2+1+2]

d) Show that the circuit of the accompanying figure 3 can simulate a grounded inductor if $R_1 > R_2$. In other words, show that the reactive part of the input impedance of the circuit is positive if $R_1 > R_2$. The OPAMP is an ideal one. [Marks 6]

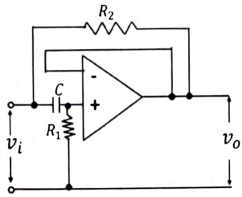

Figure 3

4. An OPAMP-based oscillator circuit (Figure 4). The signal v_s is given once and then the key switched from B point to A point

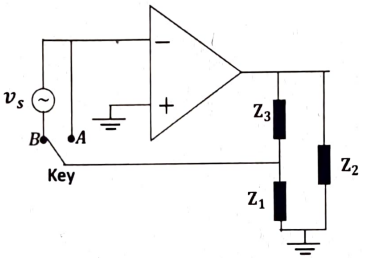

Figure 4

Considering a **non-ideal** OPAMP having *non-zero* output impedance (R_O) and *infinite input impedance* , and finite gain without load, Show that
either (i) $Z_1$and $Z_2$are capacitor and Z_3 is an inductor ,
or (ii) Z_1, Z_2 are inductor and Z_3 is a capacitor [Marks 6]
[Note: In a practical oscillator circuit no external signal voltage (v_s) is given, the signal is taken from the noise while switching on the device]

5. If $|I_{DSS}| = 4\ mA$, $V_P = 4\ V$, calculate the quiescent values of I_D, V_{GS} and V_{DS} for the circuit given below [Marks 5]

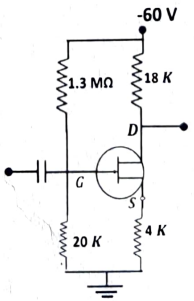

Figure 5