Benha University **Electronic circuits (B)** **Electrical Eng. Dept.**
Faculty of Engineering **3rd year communication**
Shoubra **2012-2013**

Sheet (5) - solution

1. Why is the phase shift through the RC feedback circuit in a phase shift oscillator 180°?

The three *RC* circuits contribute a total of 180°, and the inverting amplifier contributes 180° for a total of 360° around the loop.

2. What is the basic difference between the Colpitts and the Hartley oscillators?

Colpitts uses a capacitive voltage divider in the feedback circuit; Hartley uses an inductive voltage divider.

3. What is the advantage of a FET amplifier in a colpitts or Hartley oscillator?

The higher FET input impedance has less loading effect on the resonant feedback circuit.

4. How can you distinguish a Colpitts oscillator from a Clapp oscillator?

A Clapp has an additional capacitor in series with the inductor in the feedback circuit.

5. What value of R_f is required in Figure 1? What is f_r?

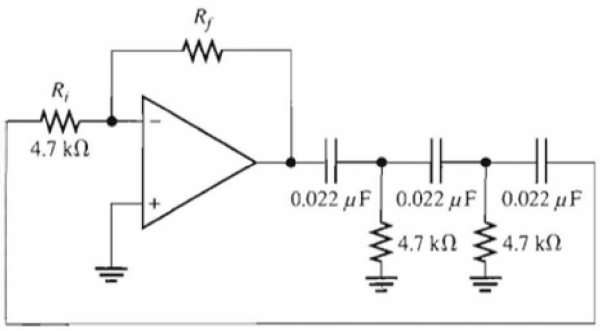

Figure 1

$$B = \frac{1}{29}$$

$$A_{cl} = \frac{1}{B} = 29$$

$$A_{cl} = \frac{R_f}{R_i}$$

$$R_f = A_{cl}R_i = 29(4.7\ \text{k}\Omega) = \mathbf{136\ k\Omega}$$

$$f_r = \frac{1}{2\pi\sqrt{6}\left((4.7\ \text{k}\Omega)(0.02\ \mu\text{F})\right)} = \mathbf{691\ Hz}$$

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6. Calculate the frequency of oscillation for each circuit in figure 2 and identify the type of oscillator. Assume Q>10 in each case.

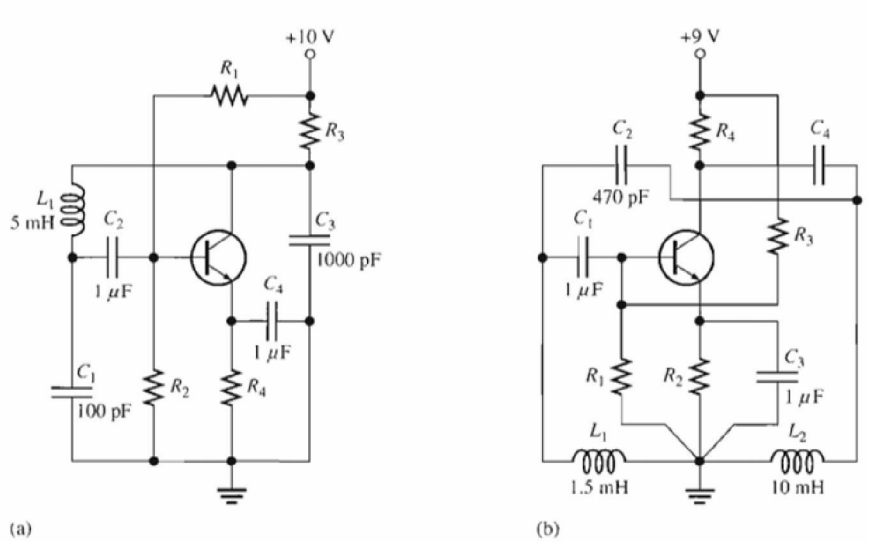

Figure 2

(a) *Colpitts*: C_1 and C_3 are the feedback capacitors.

$$f_r = \frac{1}{2\pi\sqrt{L_1 C_T}}$$

$$C_T = \frac{C_1 C_3}{C_1 + C_3} = \frac{(100\ \mu\text{F})(1000\ \text{pF})}{1100\ \text{pF}} = 90.9\ \text{pF}$$

$$f_r = \frac{1}{2\pi\sqrt{(5\ \text{mH})(90.9\ \text{pF})}} = \mathbf{236\ kHz}$$

(b) *Hartley*:

$$f_r = \frac{1}{2\pi\sqrt{L_T C_2}}$$

$$L_T = L_1 + L_2 = 1.5\ \text{mH} + 10\ \text{mH} = 11.5\ \text{mH}$$

$$f_r = \frac{1}{2\pi\sqrt{(11.5\ \text{mH})(470\ \text{pF})}} = \mathbf{68.5\ kHz}$$

7. Determine the gain of amplifier stage must be in figure 3 in order to have sustained oscillation.

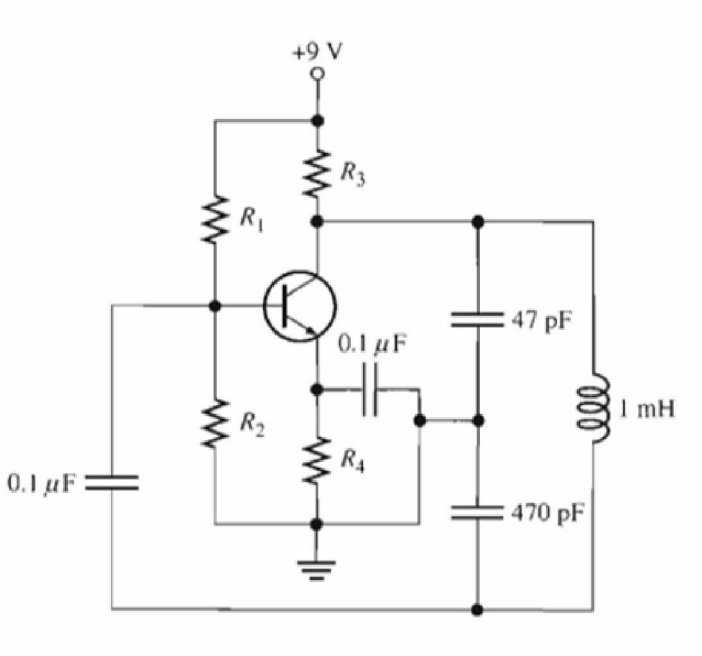

Figure 3

$$B = \frac{47\,\text{pF}}{470\,\text{pF}} = 0.1$$

The condition for sustained oscillation is

$$A_v = \frac{1}{B} = \frac{1}{0.1} = 10$$

Good Luck

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