## Chapter 6 Oscillators

# One mark questions (knowledge)

- 1. What is a positive feedback?
- 2. What is an oscillator?
- 3. What is the function of an electronic oscillator?
- 4. What type of feedback is employed in oscillator?
- 5. What are sinusoidal oscillators?
- 6. What are non-sinusoidal or relaxation oscillators?
- 7. What are damped oscillations?
- 8. What are undamped oscillations?
- 9. What type of feedback is used in sinusoidal oscillator?
- 10. What is a tank circuit or tuned circuit?
- 11. What is low frequency oscillator?
- 12. Name any one low frequency oscillator.
- 13. What is high frequency oscillator?
- 14. Name any one high frequency oscillator.
- 15. Name any one type of RC oscillator.
- 16. Name any one type of LC oscillator.
- 17. Name the oscillator circuit that produces no phase shift in the feedback network.
- 18. Write the expression for frequency of oscillations of a Wien bridge oscillator.
- 19. Write the expression for frequency of oscillations of a RC phase shift oscillator.
- 20. Write the expression for frequency of oscillations of a Colpitts oscillator.
- 21. Write the expression for frequency of oscillations of a Hartley oscillator.
- 22. Name any one material which exhibits piezo electric effect.

## One mark questions (Understanding)

- 1. Which signal acts as the starting signal for oscillations?
- 2. Write the expression for voltage gain of a positive feedback.
- 3. Mention one example for relaxation oscillator.
- 4. Mention one example for sinusoidal oscillator.
- 5. What should be the value of loop gain to start oscillations?
- 6. What should be the value of loop gain for sustained oscillations?
- 7. Classify the oscillators based on the frequency.
- 8. What type of feedback is used in Colpitts oscillator?
- 9. What type of feedback is used in Hartley oscillator?
- 10. How many RC sections are required for a phase shift oscillator?
- 11. What is the phase shift in each RC section of a phase shift oscillator?
- 12. Why is negative feedback provided in Wien bridge oscillator?
- 13. Mention the phase shift produced by the bridge network in a Wien bridge oscillator.
- 14. Mention the principle used in a crystal oscillator.
- 15. When do you prefer crystal oscillator?
- 16. Mention any one application of crystal oscillator.
- 17. Mention any one application of 555 timer.

### One mark questions (skill)

- 1. Draw the basic block diagram of an oscillator.
- 2. Draw the tank circuit consisting of one capacitor and one inductor.
- 3. Draw the tuned circuit used in Hartley oscillator.
- 4. Draw the tuned circuit used in Colpitts oscillator.
- 5. Draw the tuned circuit used in RC phase shift oscillator.
- 6. Draw the tuned circuit used in Wien bridge oscillator.
- 7. Draw the circuit symbol of a crystal.
- 8. Draw the electrical equivalent circuit of crystal.

### Two mark questions (knowledge)

- 1. What is an oscillator? How is it different from an amplifier?
- 2. Explain briefly the conditions of Barkhausen criterion.
- 3. What is a Hartley oscillator? Explain.
- 4. Write any two applications of a Hartley oscillator.
- 5. What is Colpitts oscillator? Explain.
- 6. Write any two applications of a Colpitts oscillator.
- 7. What is RC phase shift oscillator? Explain.
- 8. Write any two applications of a RC phase shift oscillator.
- 9. What is Wien bridge oscillator? Explain.
- 10. Write any two applications of Wien bridge oscillator.
- 11. What is crystal oscillator? Explain.
- 12. Write any two applications of crystal oscillator.
- 13. Explain piezoelectric effect.

#### Two mark questions (Understanding)

- 1. Distinguish between sinusoidal and relaxation oscillators.
- 2. Distinguish between damped and undamped oscillations.
- 3. Why do you use three RC sections in an RC phase shift oscillator?
- 4. Explain the tank circuit employed in Hartley oscillator.
- 5. Explain the tank circuit employed in Colpitts oscillator.
- 6. Mention any two advantages of a crystal oscillator over LC and RC oscillators.
- 7. Mention any two limitations of LC and RC oscillators.
- 8. Write any two advantages of RC oscillators over LC oscillators.
- 9. Why is quartz crystal commonly used in crystal oscillator?
- 10. Mention any two applications of a crystal oscillator.
- 11. Mention any two applications of a 555 timer.
- 12. Name the materials that exhibit piezoelectric effect and mention their application areas.

#### Two mark questions (Skill)

- 1. Draw the circuit diagram of a Hartley oscillator.
- 2. Draw the circuit diagram of a Colpitts oscillator.
- 3. Draw the circuit diagram of a RC phase shift oscillator.

- 4. Draw the circuit diagram of a Wien bridge oscillator.
- 5. Draw the circuit diagram of a crystal oscillator.
- 6. Draw the circuit symbol and equivalent circuit of crystal.
- 7. Draw the pin diagram of 555 timer IC.

## Three mark questions (knowledge)

- 1. Explain briefly how the oscillations are produced in a LC tank circuit.
- 2. Explain the working of 555 timer IC in brief.

## Three mark questions (Understanding)

- 1. Draw the circuit diagram of a Hartley oscillator. Mention the expression for its frequency of oscillations.
- 2. Draw the circuit diagram of a Colpitts oscillator. Mention the expression for its frequency of oscillations.
- 3. Draw the circuit diagram of a RC phase shift oscillator. Write the expression for its frequency of oscillations.
- 4. Draw the circuit diagram of a Wien bridge oscillator. Write the expression for its frequency of oscillations.

## Three mark questions (skill)

- 1. Draw the circuit diagram of crystal oscillator. Draw the electrical equivalent circuit of a crystal.
- 2. Draw the functional block diagram of 555 timer.

## Five marks questions (understanding)

- 1. With a circuit diagram explain the working of a Hartley oscillator. Write the expression for its frequency and feedback factor.
- 2. Draw the circuit diagram of Colpitts oscillator and explain its action. Write the expression for its frequency and feedback factor.
- 3. Explain the action of an op-amp RC phase shift oscillator with a circuit diagram. Write the expression for its frequency and feedback factor.
- 4. Draw the circuit diagram of an op-amp Wien bridge oscillator and explain its working. Write the expression for its frequency and feedback factor.
- 5. Explain the working of crystal oscillator with a circuit diagram. Write the expression for its frequency of oscillation.

## PROBLEMS

1. A transistor Colpitts oscillator has L = 4 mH,  $C_1 = 10 \text{ nF}$  and  $C_2 = 10 \text{ nF}$ . Determine the frequency of oscillations.

(Ans: 35.6 kHz)

2. A Colpitts oscillator circuit is to generate a frequency of 24 kHz. The capacitors used are  $C_1 = 0.2 \mu$ F and  $C_2 = 0.22 \mu$ F. Find the value of an inductor use.

(Ans: 0.42 mH )

3. A Colpitts oscillator oscillates at 1.13 MHz. If the inductor in the feedback network has a value of 20  $\mu$ H and one of the capacitors value is 0.1  $\mu$ F. Calculate the value of the other capacitor.

(Ans: 0.001 μF)

- 4. Calculate the frequency of oscillations and feedback ratio in a Colpitts oscillator circuit containing the tank circuit with L=  $10\mu$ H, C<sub>1</sub>=  $0.22\mu$ F and C<sub>2</sub>=  $0.47\mu$ F. (Ans: 0.13 MHz, 0.46)
- 5. A Hartley oscillator has  $L_1 = 3$  mH,  $L_2 = 5$  mH and C = 10 nF. Determine the frequency of oscillations. (Ans: 17.8kHz)
- 6. A Hartley oscillator circuit is to generate a frequency of 1200 kHz. If the capacitor in the feedback network has a value of 220 pF and one of the inductors value is 20 µH, calculate the value of the other inductor.

(Ans: 60.03µH)

7. A Hartley oscillator oscillates at 54 kHz. The inductance of inductors used are  $L_1 = 30$  mH and  $L_2=60$  mH. Find the value of capacitance of the capacitor.

(Ans: 96.61 pF)

8. Calculate the frequency and feedback ratio of the circuit shown below.

9. A RC phase shift oscillator uses three identical RC sections in the feedback network. The values of the components are R = 680  $\Omega$  and C = 220 nF. Determine the frequency of oscillation.

10. What should be the value of capacitor required for a phase shift oscillator to produce a frequency of

v.

11. The frequency of the phase shift oscillator is 125 Hz. If the value of capacitance of the capacitor used is 0.22 µF, calculate the value of resistance used.

12. The frequency of the Wien bridge oscillator is 1200 Hz. If the resistance value used is 820  $\Omega$ , calculate the value of capacitance to be used.

- 13. The RC network of Wien bridge oscillator consists of resistors and capacitors of values  $R_1=R_2=R=270k\Omega$ and  $C_1=C_2=C=470pF$ . Determine the frequency of oscillations.
- 14. The frequency of the Wien bridge oscillator is 1500 Hz. If the capacitance value used is  $C_1=C_2=C=0.1 \mu F$ , (Ans: 1061.5Ω) calculate the value of resistance  $R_1=R_2=R$  to be used.

To the amplifier circuit

338 Hz, if the resistance used is 220  $\Omega$ ?

From the amplifier circuit 3mH 1000 pF

(Ans: 434.5Hz)

(Ans: 56.3 KHz, 0.176)

(Ans: 0.874 µF)

(Ans: 2363.9 Ω)

(Ans: 0.161 µF)

(Ans: 1254.8 Hz)