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Department of Biomedical Engineering

Course Name: 23BMB101-Electron Devices and Circuits

I Year : II Semester

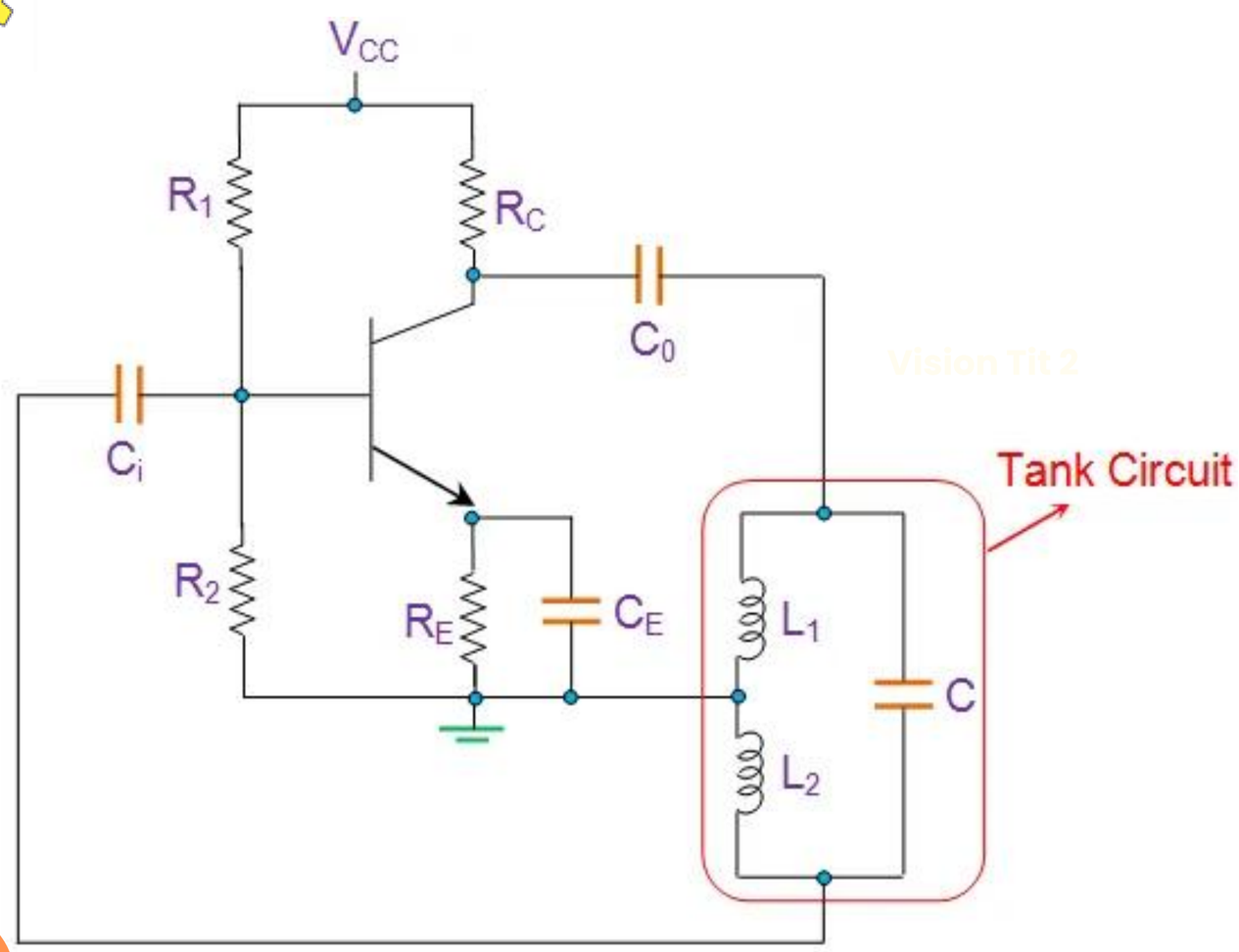
Unit V –Feedback Amplifiers and Oscillators

Topic : Hartley Oscillator

INTRODUCTION

- The Hartley oscillator is an electronic oscillator circuit in which the oscillation frequency is determined by the tuned circuit consisting of capacitors and inductors, that is, an LC oscillator.
- Hartley oscillators are typically tuned to produce waves in the radiofrequency band (which is why they are also known as RF oscillators).
- The distinguishing feature of a Hartley oscillator is that the tuning circuit consists of a single capacitor in parallel with two inductors in series (or a single tapped inductor), and the feedback signal needed for oscillation is taken from the centre connection of the two inductors.

Construction



- Here the R_C is the collector resistor while the emitter resistor R_E forms the stabilizing network.
- Further the resistors R1 and R2 form the voltage divider bias network for the transistor in common-emitter CE configuration.

Oscillator - Construction

- The capacitors Ci and Co are the input and output decoupling capacitors while the emitter capacitor C_E is the bypass capacitor used to bypass the amplified AC signals.
- All these components are identical to those present in a common-emitter amplifier which is biased using a voltage divider network.
- On switching ON the power supply, the transistor starts to conduct, leading to an increase in the collector current, I_C which charges the capacitor C.
- On acquiring the maximum charge feasible, C starts to discharge via the inductors L1 and L2. These charging and discharging cycles result in the damped oscillations in the tank circuit.

Oscillators

- The oscillation current in the tank circuit produces an AC voltage across the inductors L_1 and L_2 which are out of phase by 180^o as their point of contact are grounded.
- The output of the amplifier is applied across the inductor L1 while the feedback voltage drawn across L2 is applied to the base of the transistor.
- At this state, if one makes the gain of the circuit to be slightly greater than the feedback ratio given by

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$$\beta = \frac{L_1}{L_2}; \quad if\ the\ coils\ are\ wound\ on\ different\ cores$$

$$\beta = \frac{L_1 + M}{L_2 + M}$$

Hartley Oscillator

- The frequency of such an oscillator is given as

$$F = \frac{1}{2\pi\sqrt{L_{eff}C}}$$

L_{eff} *is the effective series inductance which is expressed as*

$L_{eff} = L_1 + L_2$; *if the coils are wound on different cores*

$L_{eff} = L_1 + L_2 + 2M$; *if the coils are wound on the same core*