Ex. No.:3 **Date:** 10/10/19

Response of RLC Series Circuit

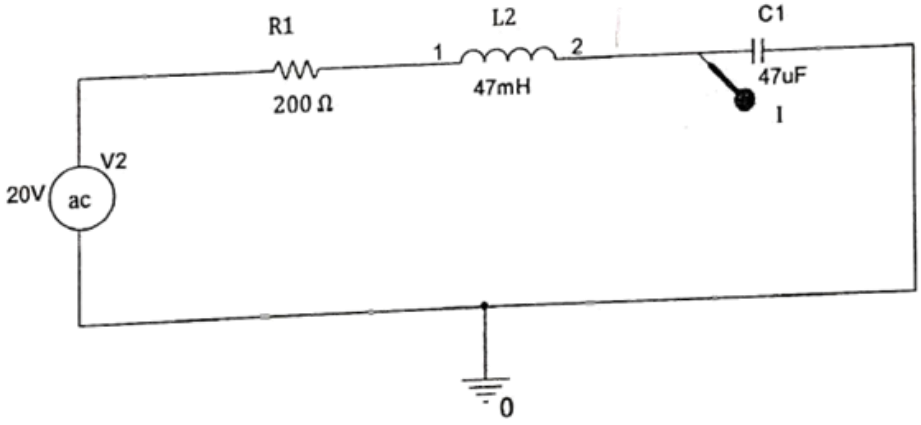
Aim: To determine and verify the resonant current & resonant frequency for the given RLC circuit by theoretical and simulation values.

Apparatus/Tool required:

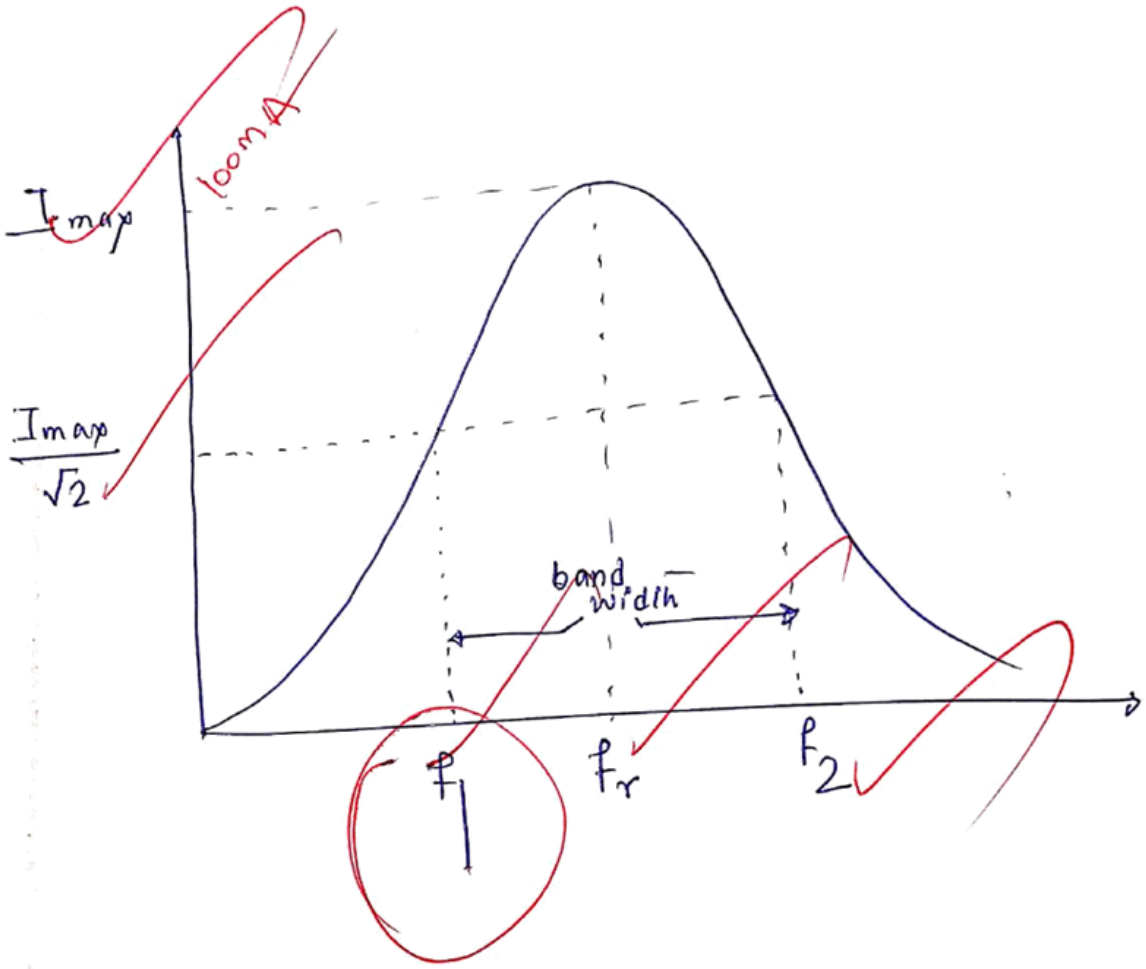
ORCAD / Capture CIS --> **Analog Library – R, L & C**
Source Library – Vac
Ground (GND) – 0 (zero)

Simulation Settings: **Analysis Type – Transient (Time Domain)**
Run to time: 20ms

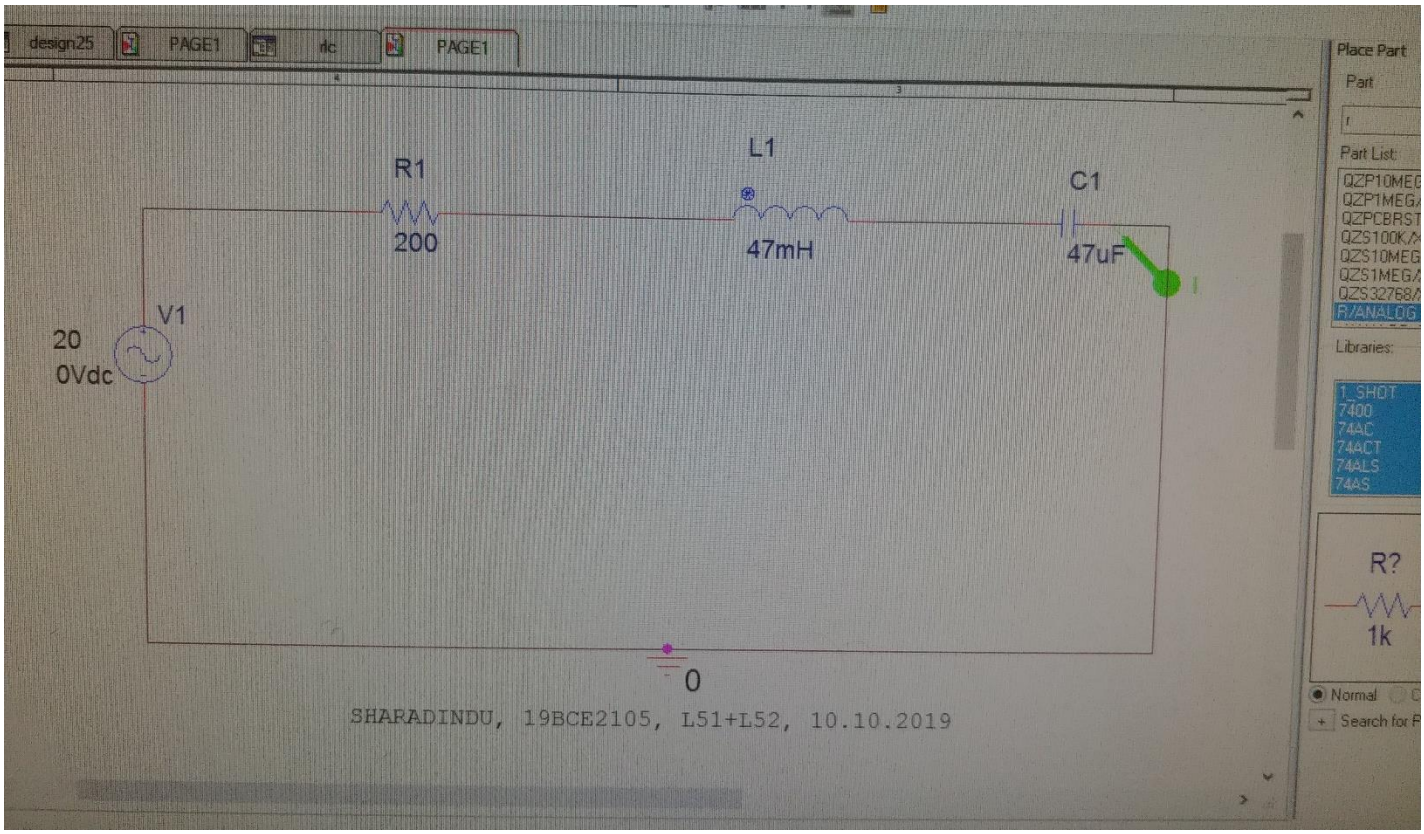
Circuit Diagram:

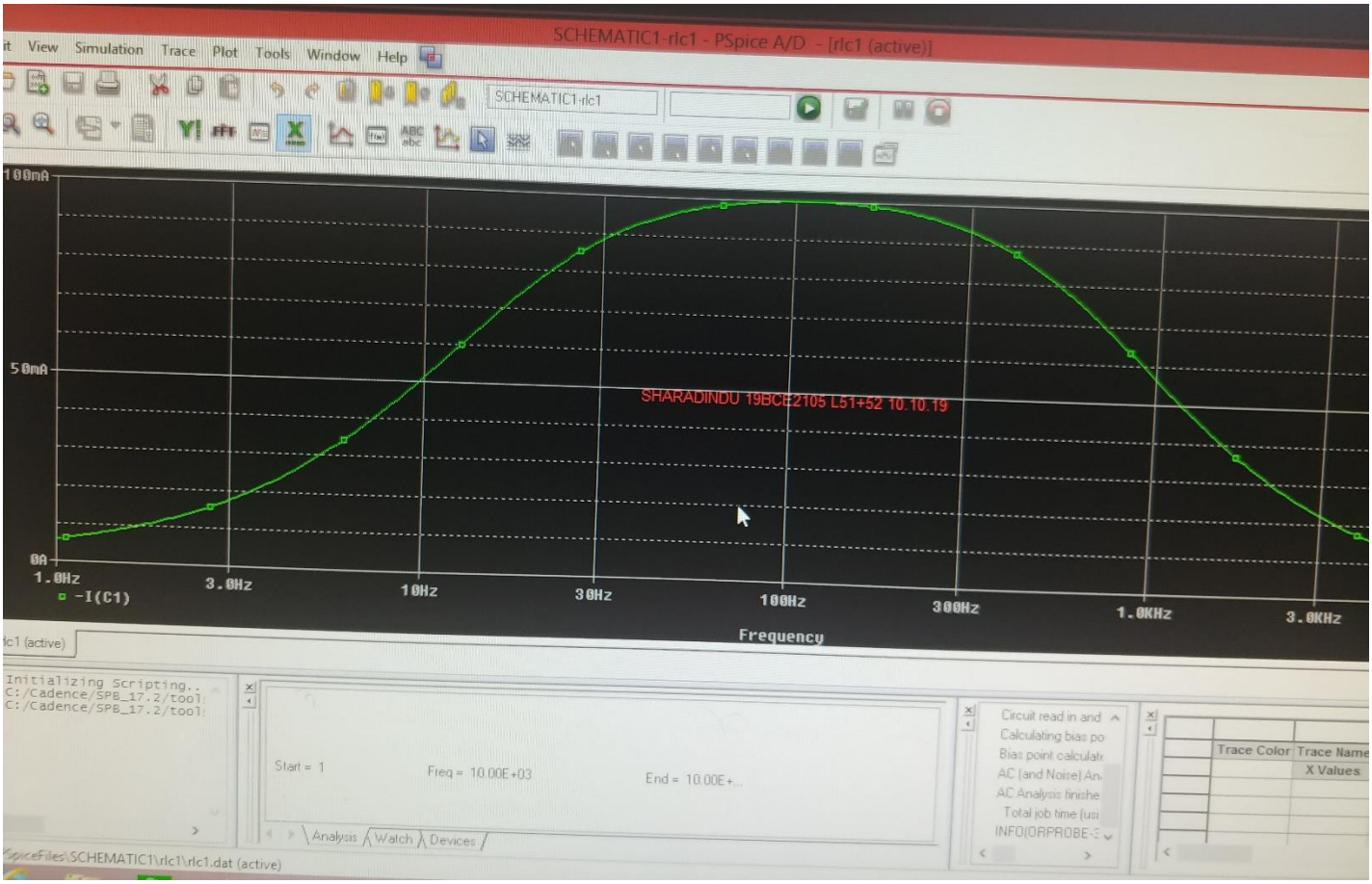


Theory:

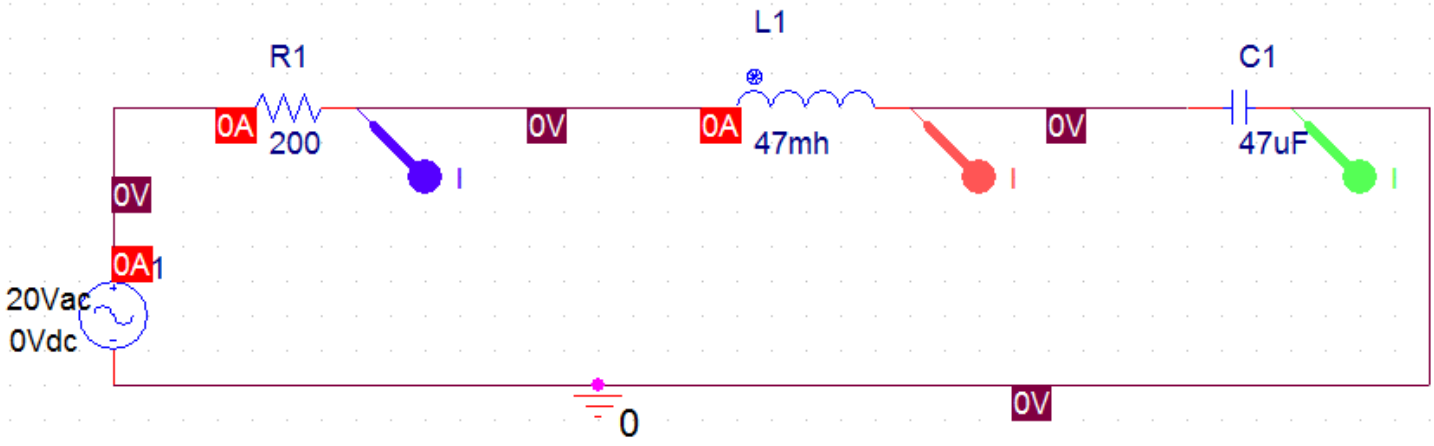

100mA
I_{max}
$i_{rms} = \frac{I_{max}}{\sqrt{2}}$
band width
f_1
f_r
f_2

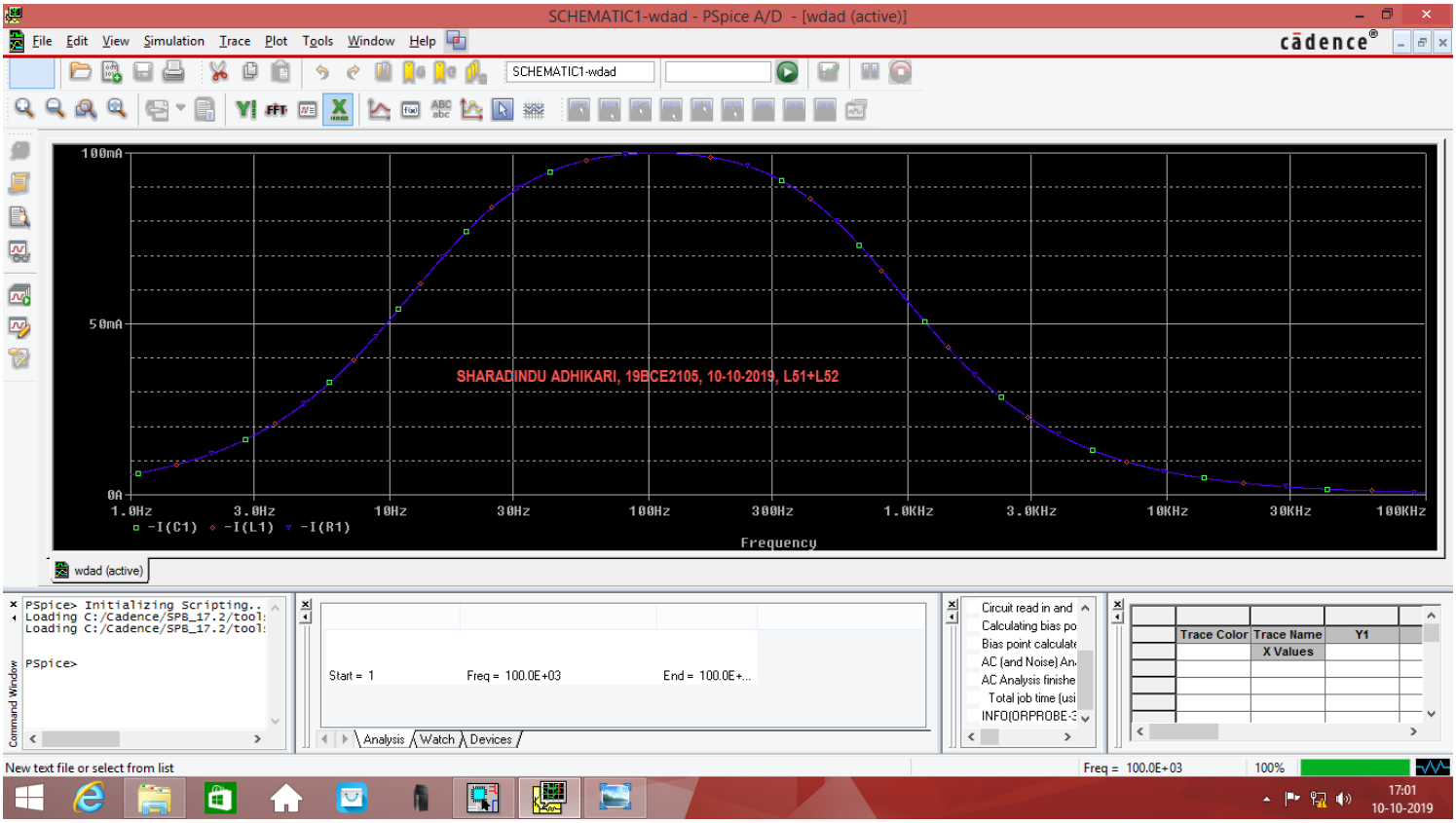
Circuit Diagram & Graph:





Circuit Diagram & Graph (..contd.):





Formulae :

$$i = \frac{V}{Z} = \frac{V}{R\ (= Z_r)}$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$i = \frac{V}{Z}$$

$$X_L = X_C$$

$$Z_r = R$$

Calculation:

$$X_{Lr} = X_{Cr}$$

$$2\pi f_r L = \frac{1}{2\pi f_r C}$$

$$4\pi^2 f_r^2 LC = 1$$

$$f_r^2 = \frac{1}{4\pi^2 LC}$$

$$f_r = \sqrt{\frac{1}{4\pi^2 LC}}$$

$$f_r = \frac{\sqrt{1}}{\sqrt{4\pi^2 LC}}$$

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$f_r = \frac{1}{2\pi\sqrt{47\times10^{-3}\times47\times10^{-6}}}$$

$$\boxed{f_r = 107.1\ \text{Hz}}$$

$$i_r = \frac{V}{Z} = \frac{V}{Z_r\ (= R)}$$

$$i_r = \frac{20}{200}\ \text{Amp}$$

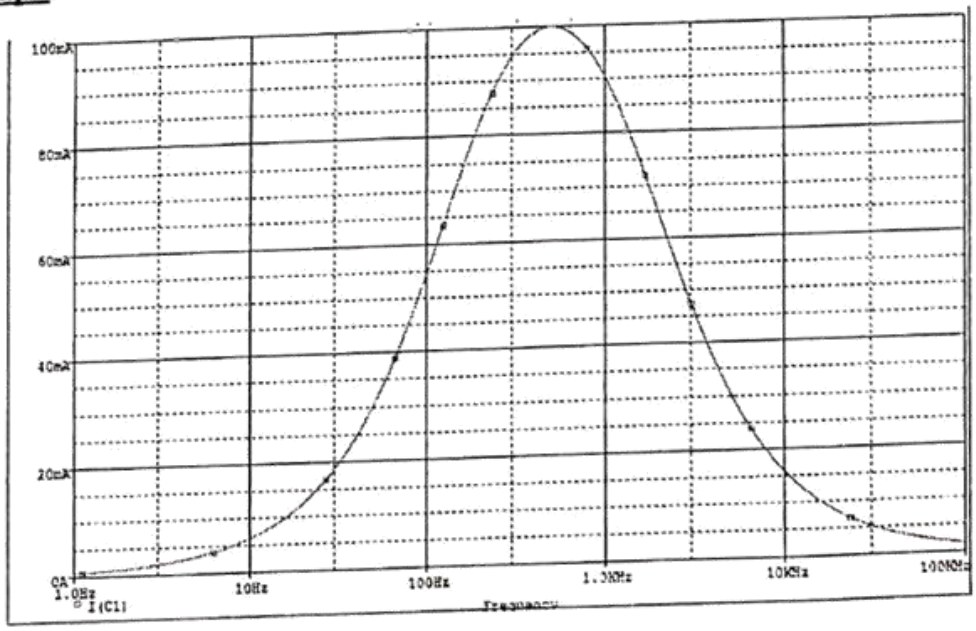
$$i_r = 0.1\ \text{Amps}$$

$$\boxed{i_r = 100\ \text{m Amp.}}$$

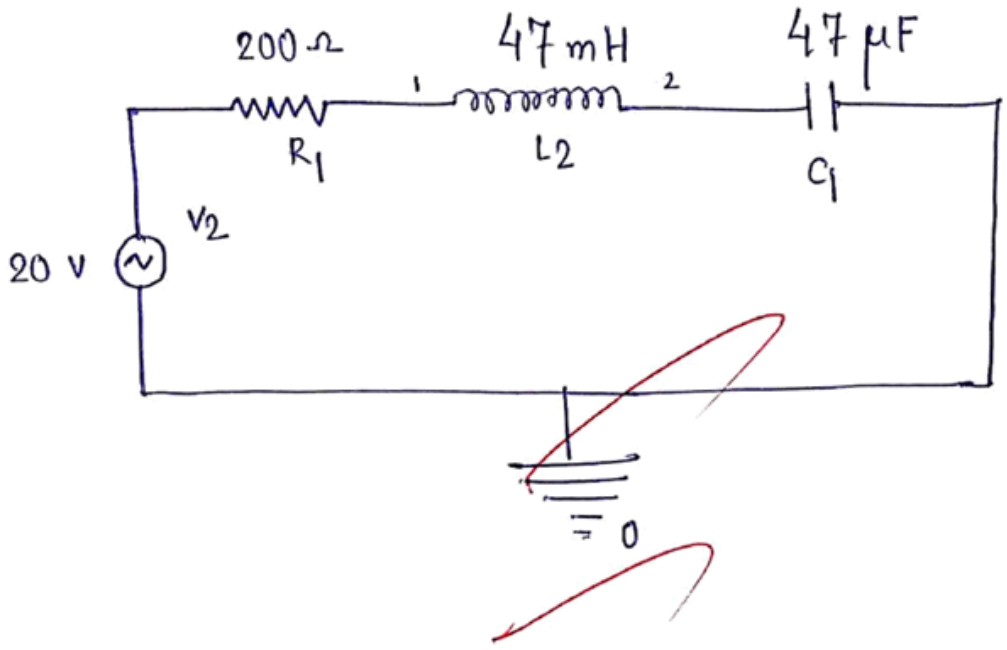
$$\therefore Q = \frac{1}{R}\sqrt{\frac{L}{C}}.$$

$$\therefore \text{Q-factor} > 200$$

Model Graph:



Simulation Circuit Diagram and Output:



$i_r = 100\ mA$

$f_r = 107.1\ Hz$

Procedure:-

Result:- The series resonance RLC circuit have been performed in CIS Capture as simulation and the following theoretical and simulation values are tabulated :-

parameter	Theoretical values	Simulation values
i_r	100 mA	100 mA
f_r	107.1 Hz	107.1 Hz

Inference:-

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