Midterm

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① $f_o = 90\,MHz$, $BW = 2\,MHz$, Series RLC resonance

Sol/ $\because$ $BW = \frac{R}{L}$ (rad/sec)

$\therefore (2\times10^6 \times 2\pi) = \frac{R}{L}$

let $R = 100\,\Omega$ مثلاً $\therefore$ $L = \frac{100}{2\times10^6\times 2\pi} \cong 7.95\,\mu H$

نفرض قيمة R صغيرة في حالة series

$\because$ $\omega = \frac{1}{\sqrt{LC}}$ $\therefore$ $2\pi\times90\times10^6 = \frac{1}{\sqrt{7.95\times10^{-6}\times C}}$

$\therefore$ $C \cong 0.39\,pF$

ط آخ

$Q = \frac{f_o}{BW} = \frac{90M}{2M} = 45$

$Q = \frac{\omega L}{R} = \frac{1}{\omega RC}$

$\omega = 2\pi\times90\times10^6$

$\therefore$ $45 = \frac{(2\pi\times90\times10^6)L}{R}$

at $R = 100$, $L = 7.95\,\mu H$

$45 = \frac{1}{\underbrace{(2\pi\times90\times10^6)}_{\omega}\underbrace{\times100}_{R}\times C}$

$\therefore$ $C = 0.39\,pF$

② ideal Parallel Res

$$Q = 45 = \frac{R}{\omega L} = \omega RC$$

$$BW = \frac{1}{RC}$$

الحل الأول

$$BW = \frac{1}{RC} \text{ rad/sec}$$

$$2\pi \times 2\times10^{6} = \frac{1}{RC}$$

فيكون فرض قيمة R لعدم وجود عامل parallel

(فش هدي تفرض بالاختيار)

∴ You select $R = 100\,\Omega$

$$C_1 = \frac{1}{2\pi \times 2\times10^{6} \times 100} = 0.795\,nF$$

∴ You select $R = 1K$

$$C_2 = 79.5\,pf$$

$$\omega = \frac{1}{\sqrt{L_1 C_1}} = 2\pi \times 90\times10^{6}$$

$$L_1 = 3.93\,nH$$ لو R=100

∴ used C_2 لو R=1K

$$L_2 = 39.3\,nH$$

الحل الثاني

$Q = \omega RC$ at $(R=100)$

$$Q = (2\pi \times 90\times10^{6})(100)C = 45$$

$$\therefore C = 0.795\,nF$$

at $R = 1k$ $C = 79.5\,pf$

$$Q = \frac{R}{\omega L}$$

$$45 = \frac{100 \text{ (or } 1000)}{(2\pi \times 90\times10^{6}) L}$$

$R = 100$: $L = 3.93\,nH$

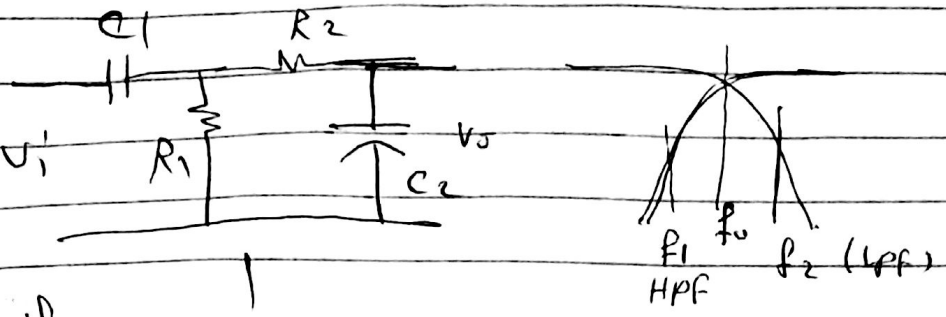
$R = 1000$: $L = 39.3\,nH$

∵ $Q > 10$ ∴ use Approx.

$$f_1 = f_0 - BW/2 = 90 - 2/2 = 89\,MHz$$

$$f_2 = f_0 + BW/2 = 91\,MHz$$

(3) BPF using R's & C's



HPF

$$f_1 = \frac{1}{2\pi R_1 C_1}$$

$$f_1 = f_0 - BW/2 = 89\,MHz$$

$$\therefore 89 \times 10^6 = \frac{1}{2\pi (100) C_1} \qquad \text{let } R_1 = 100$$

$$C_1 = 56.1\,pF$$

LPF

$$f_2 = \frac{1}{2\pi R_2 C_2}$$

$$f_2 = f_0 + BW/2 = 91\,MHz$$

$$91\,MHz = \frac{1}{2\pi (100) C_2} \qquad \text{let } R_1 = R_2$$

$$C_2 = 54.9\,pF$$

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(4) $Q = 55$, $BW = 2\,MHz$

$\therefore Q = f_0/BW$, $f_0 = 2 \times 55\,MHz = 110\,MHz$

$\therefore 2\%$, $f_1 = f_0 - BW/2 \simeq 109\,MHz$

$f_2 = f_0 + BW/2 \simeq 111\,MHz$

$\therefore$ f_0, f_1, f_2 out of range of FM Band where FM Band is between 88M & 108 MHz only

Will not Release

Benha University
Faculty of Engineering- Shoubra
Electrical Engineering Department
1st Year (Communications & Electronics)

Mid-Term Exam
Date: 30/03/2017
ECE 122 Electrical Circuits (2)
Duration : 1 Hour

- Answer all the following questions
- Illustrate your answers with sketches when necessary.
- The exam consists of **One** page
- ***(put your final results in a border)***
- Total Mark: **20** Marks
- Examiners: Dr. Moataz Elsherbini

1. *It is required to broadcast a* ***shoubra radio*** *station to be detected through your FM radio. Design a suitable series RLC circuit to verify this mission. The station must be heard within bandwidth of 2MHz, while the most purity sound heard at 90MHz.* ***(6 marks)***

2. *Your close friend in your project team suggested broadcasting the same station by using ideal parallel resonance circuit. Make all necessary modifications to verify the required design at the same resonant frequency and BW, then* ***Calculate*** *the upper and lower cut off frequencies obtained from the new design.* ***(6 marks)***

3. *Another partner in your project team claimed that he can use passive BPF (using Resistors and Capacitors only) to achieve the same resonant frequency and bandwidth. Provide the necessary help to reach the suitable design.* ***(6 marks)***

4. *A genius student tries to change the design to obtain Quality factor of 55 at BW of 2MH. will he success receiving the channel with FM mobile radio?(why?).* ***(2 marks)***

The world makes way for the man who knows where he is going

Dr/ Moataz Elsherbini

M. Elsherbini

29/3/2017