Benha University
Faculty of Engineering- Shoubra
Communications and Computer Engineering Program
Final Exam – Term 192 **of Academic Year** 2018 - 2019
Course: Electric Circuits (2) **Code: CCE205**
Duration: 2 hours

- Answer all the following questions
- Illustrate your answers with sketches when necessary.
- No. of questions: 6
- Total Mark: 40 Marks

PART II

Q4)

*It is required to broadcast a shoubra radio station which detected through FM radio. Design a suitable practical parallel resonance circuit using coil has impedance of **10+j3000Ω** to verify the required broadcasting. The circuit has to be heard between **(89MHz and 91 MHz)** and very clear at **90MHz**. (**7 marks**)*

Model answer

Final
10 Marks

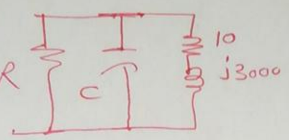
1

$\ell = R_{coil} + j\omega L = 10 + j3000$ ($R_\ell = 10$, $X_\ell = 3000$)

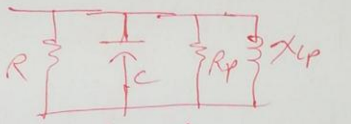
$f_o = 90MHz$

$Bw = 2MHz$ → $f_1 = 89M$, $f_2 = 91M$

Design practical parallel



Convert to ideal



$R_p = \frac{R_\ell^2 + X_\ell^2}{R_\ell} = \frac{10^2 + 3000^2}{10} \cong 900k$

$X_{Lp} = \frac{R_\ell^2 + X_\ell^2}{X_\ell} = \frac{10^2 + 3000^2}{3000} \cong 3000$

$Q = \frac{f_o}{Bw} = \frac{90}{2} = 45$

$\omega_p = 2\pi f_p = 2\pi \times 90M = 565.4$ ~~k~~ rad/s

$Q = \frac{R}{X_{Lp}} = 45 \quad \therefore R_t = 3000 \times 45 = 135K$ (~~66.6~~)

$\frac{1}{135K} = \frac{1}{900k} + \frac{1}{R_1} \longrightarrow R_1 =$ ~~66.67~~ $158.82K$

$Bw = \frac{1}{R_t C} = 2 \times 10^6 \times 2 \times \pi$ (R_t: ~~158.82k~~ 300k)

$C \cong 0.26\,Pf$

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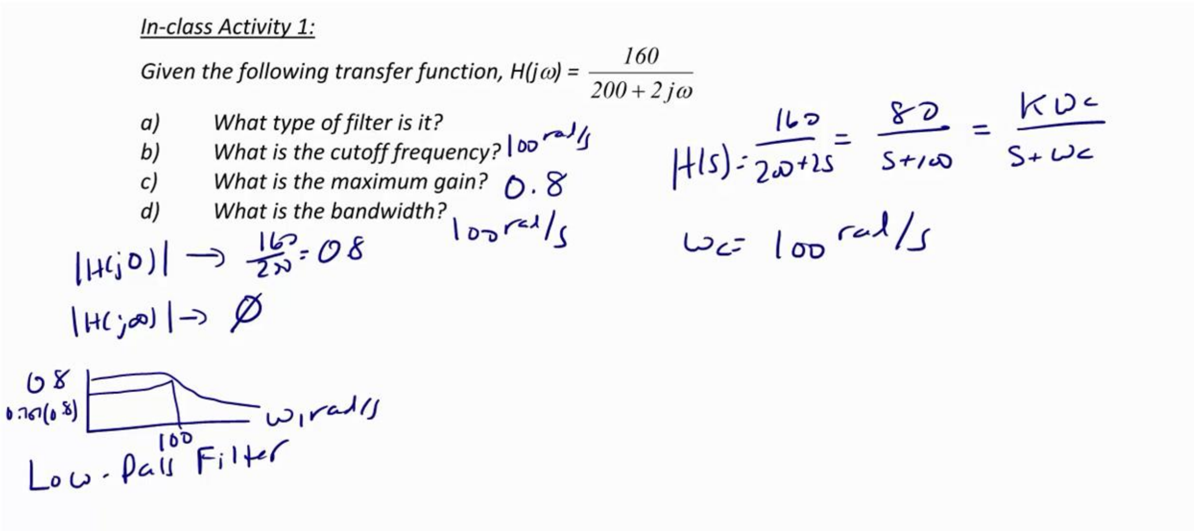
Q5)

Given the following transfer function, H(s) = $\frac{\mathbf{160}}{\mathbf{200+2}j\omega}$ *, find the following requirements:* ***(<u>6 marks</u>)***

i. *the type of filter is it?*
ii. *the cut off frequency?*
iii. *the bandwidth?*



Q6)

For the circuit shown below in figure (1), if $\boldsymbol{R_L}$***= 2Ω; L=10mH****, calculate:*

i. *Obtain the transfer function of the circuit ,*
ii. *Justify the type of filter*
iii. *Determine the value of* ***C*** *in order to get the minimum value of the modulus of the frequency response for* $\boldsymbol{\omega = 100}$ *rad/s.*

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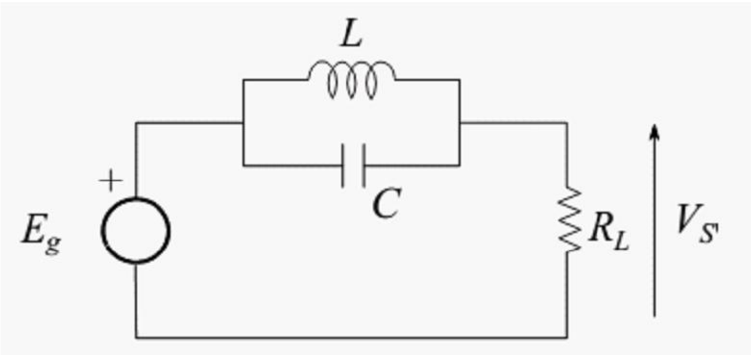

Figure (1)

(<u>7 marks</u>)

[3] C → min |Freq. Response| at ω = 100 rad/s

(4) 3 dB cutoff freq.

— Sol —

$$\frac{V_o}{V_{in}} = \frac{R}{R + X_L // X_C} = \frac{1}{1 + \frac{X_L // X_C}{R}}$$

$$= \frac{1}{1 + \frac{\left[\frac{\left(\frac{1}{j\omega C}\right) \times j\omega L}{j\omega L + \frac{1}{j\omega C}}\right]}{R}}$$

$$\frac{V_o}{V_{in}} = \frac{1}{1 + \frac{L/RC}{j(\omega L - \frac{1}{\omega C})}} \quad *$$

$$T.f = \frac{1}{1 - j\left(\frac{L/RC}{\omega L - \frac{1}{\omega C}}\right)} \quad *$$

$\omega = 0 \rightarrow T.f = 1$ band stop filter

$\omega = \infty \rightarrow T.f = 1$

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$$T.f = \frac{1}{1 - j\left(\frac{L/RC}{\omega L - \frac{1}{\omega C}}\right)}$$

$$|T.f| = \frac{1}{\sqrt{1 + \left(\frac{L/RC}{\omega L - \frac{1}{\omega C}}\right)^2}} = 0$$

(denominator) $\rightarrow \infty$

$$1 + \frac{L/RC}{\left(\omega L - \frac{1}{\omega C}\right)^2} = \infty$$

$$\infty = \frac{L/RC}{\left(\omega L - \frac{1}{\omega C}\right)^2}$$

(denominator) $\rightarrow 0$

$$\left(\omega L - \frac{1}{\omega C}\right)^2 = 0$$

$$\omega L = \frac{1}{\omega C}$$

$$\omega = \frac{1}{\sqrt{LC}}$$

$$\omega^2 = \frac{1}{LC}$$

$$C = \frac{1}{\omega^2 L} = 10\,mF$$

$L \rightarrow 10\,mH$, $\omega \rightarrow 10$

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