**SCENARIO**

You are an electrical technician in an electronics factory. Your supervisor asked you to work on solving some practical issues in different types of circuits that you are used in the products. Try to use your knowledge about circuit theory and transformation techniques to simplify and solve those problems.

**To achieve the assessment criteria for pass (P1.2 part 2/2) you must answer the following task:**

**Task 1:**

**A)**

**Internal Impedance**

20 + j 20 Ω





**Receiver device**

**Dish Antenna**

A certain type of Satellite TV **Receiver** is produced in your factory, in a certain situation the receiver receives a signal of **E = 120 mV. The receiver has** internal impedance of 20 + j 20 Ω

The **Dish Antenna** that is connected to the **receiver** may be modeled as:

1. A pure resistive load = **R.**
2. Complex impedance **Z = R + j X**.

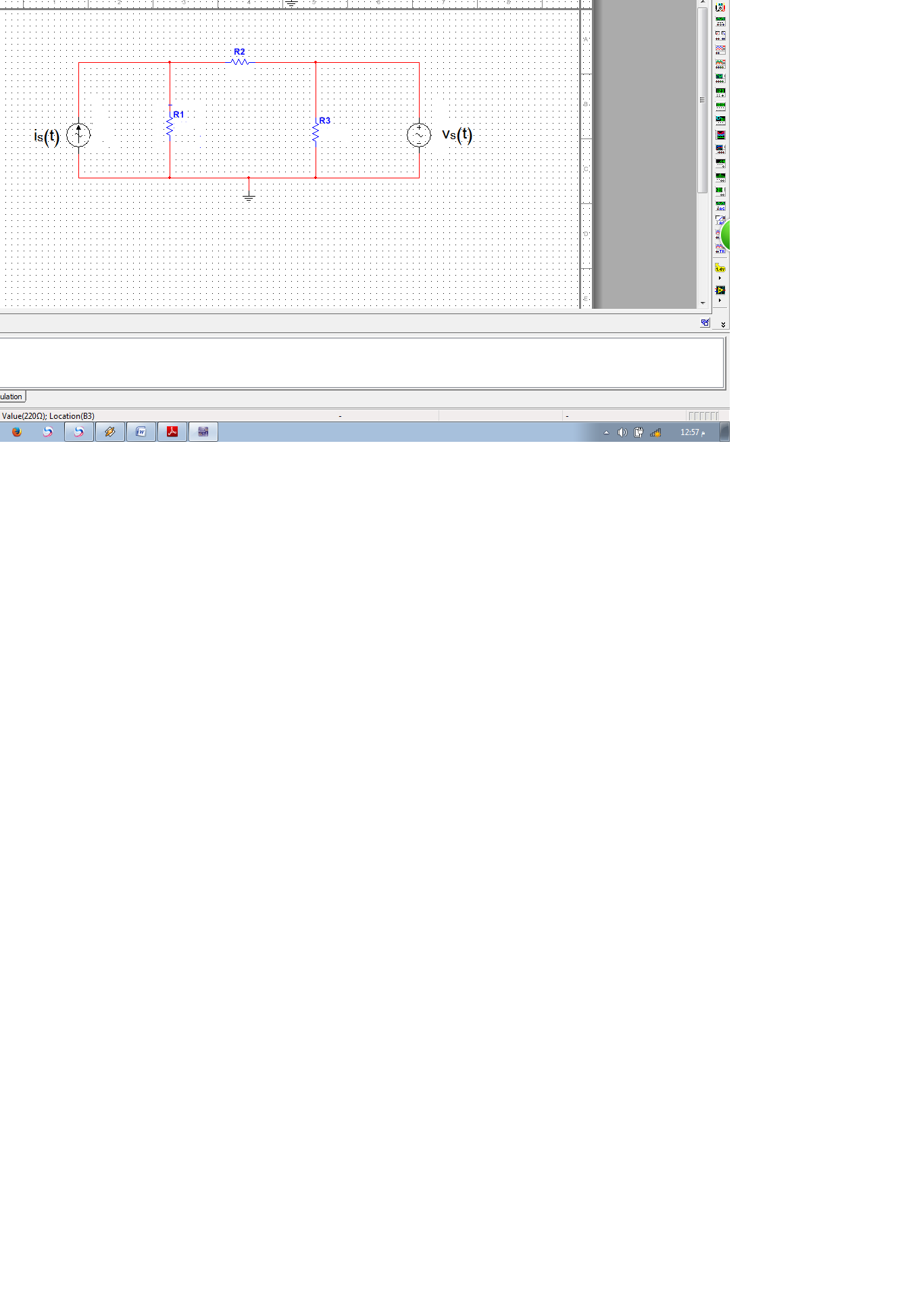
**For both cases apply circuit theory technique to solve such a problem to get the maximum power transferred to the receiver.**

**B)**

1. Using suitable software package, verify the superposition theorem in the circuit below. To measure the value VR1, VR2. Adjust the value of input sources is(t) = , vs(t) then value resistance R1= Ω ,

R2= Ω and R3= Ω

**Then verify your answer using analytically method**



**To achieve the assessment criteria for pass (P1.4 part 2/2) you must answer the following task:**

**Task 2:**

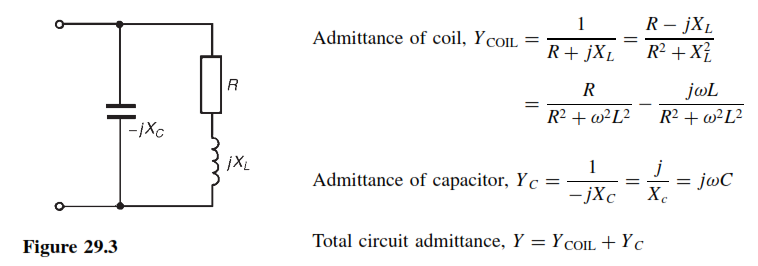
A band pass filter is a circuit used in many applications to pass certain frequency like in radio receiver. A band pass filter designed with parallel LR-C network as shown in the following figure.

1. Draw the circuit below in your simulator software.
2. If R= 50 Ω , L = 20 mH and C= 200 nF determine using your simulation the resonant frequency.
   * Put supply 50 V.
   * Change the frequency of the source from 500 Hz to 5 kHz (Step 250 Hz).
   * Measure the supply current each time.
   * Put your results into a table like:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **F** |  |  |  |  |
| **I** |  |  |  |  |

* + Plot I versus f, then according to this relation determine the fr.

1. Determine dynamic resistance.
2. Determine the quality factor.
3. Determine the band width.
4. Comment on the filter selectivity.



**To achieve the assessment criteria for pass (P1.3) you must answer the following task:**

**Task 3:**

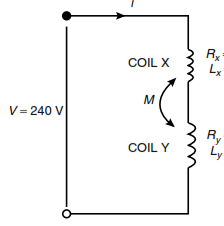
1. **Analyze the operation of a transformer as a magnetically coupled circuit.** The transformer has 300 primary turns and 75 secondary turns. The primary and the secondary resistances are 0.5Ω and 0.1 Ω respectively and the corresponding reactance is 1.5 Ω for the primary and 0.4 Ω for the secondary, then determine the equivalent:

* Resistance.
* Reactance.
* The equivalent impedance referred to the primary winding.

1. Two mutually coupled coils X and Y are connected in series as the following figure. Coil X has an inductance of 80 mH and 200 turns Coil Y has an inductance of 60 mH and 100 turns. At a certain instant after the circuit is connected, the current changing the flux by 5mWB in the second coil.

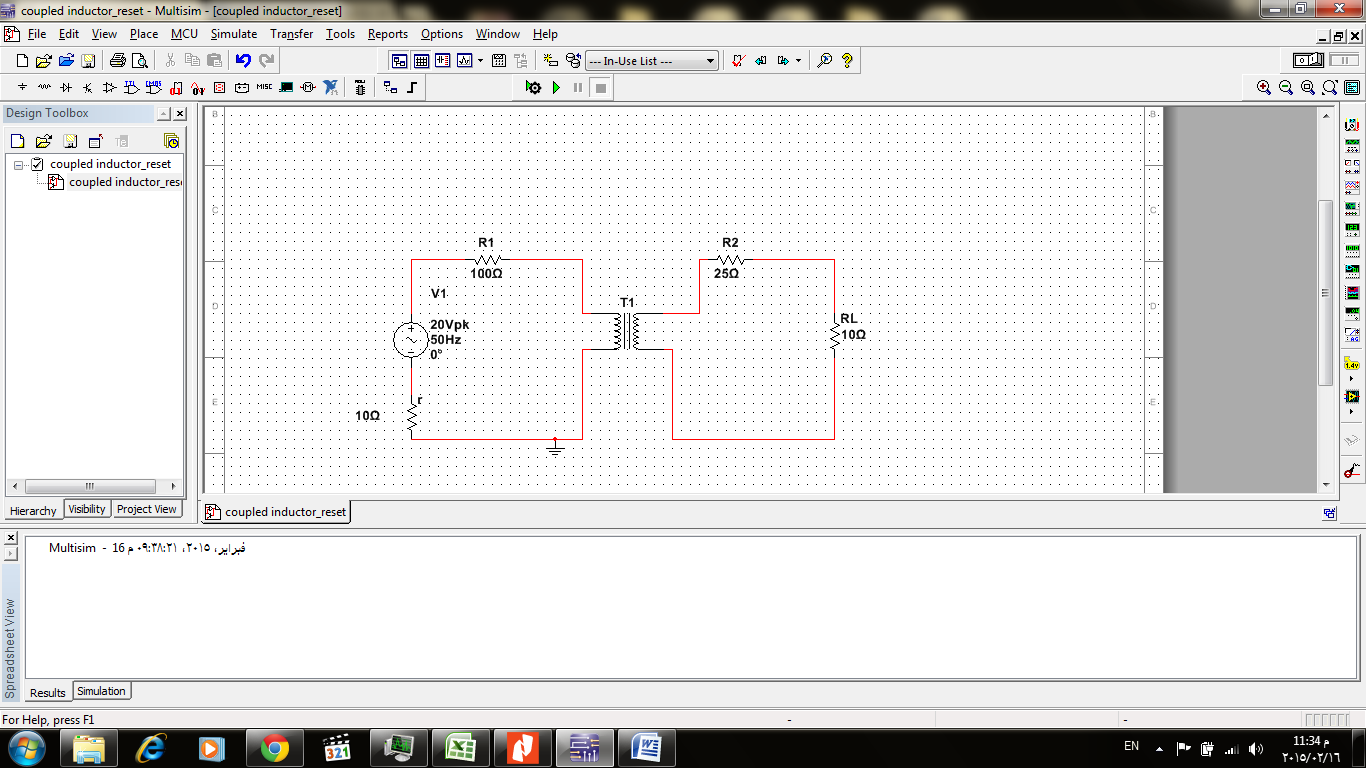
* Analyze the operation of this magnetically coupled circuit.
* Determine:

1. The mutual inductance between the coils.
2. The coefficient of coupling.

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1. A mutual inductor is used to couple a 10 Ω resistive load to a 20 V generator as shown in the following figure. The supply frequency is 50 Hz. L1 = 0.5 H, L2 = 1 H and coupling coefficient = 0.8.

* Analyze the operation of the circuit.
* Simulate the circuit to find i1 and i2.

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