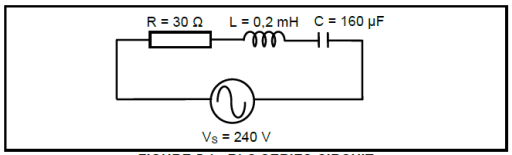
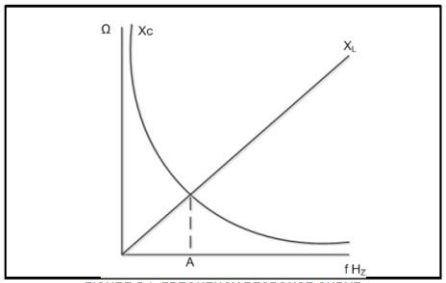
SUBJECT and GRADE	**Electrical Technology Grade 12**
TERM 1	**Week 3**
TOPIC	RLC lesson 1
AIMS OF LESSON	Doing revision on the basics of series RLC circuits with special reference to: Inductive reactance, capacitive reactance, impedance, phase angle, resonance, power factor, Q-factor and bandwidth
RESOURCES	***Paper based resources***
	Electrical Technology Grade 12 textbook (pg. 21-46, 56-70) *NSC Exam Papers November 2018 – 2020* *Grade 12 exemplar paper 2018*
INTRODUCTION	*1. For this lesson, you should know all the work done in grade 11 on RLC circuits.* *2. The purpose of the lesson to recap the series RLC circuits by working through some typical questions relating to series RLC circuits.* *3. By working through these questions, you will consolidate the work done on series RLC circuits.*
CONCEPTS AND SKILLS	*Typical Questions* **QUESTION 5: RLC** 5.1 Describe ONE practical method of obtaining resonant frequency in a parallel RLC circuit. (3) 5.2 Name ONE method that could be used to improve a poor power factor. (1) 5.3 A parallel RLC circuit is at resonant frequency. Describe what would happen to the current flow if the frequency is decreased below resonant frequency. (3) 5.4 Study the circuit in FIGURE 5.1 below and answer the questions that follow.  **FIGURE 5.1: RLC SERIES CIRCUIT** Calculate the: 5.4.1 Resonant frequency (3) 5.4.2 Total current flowing through the circuit at resonance (3) 5.4.3 Q-factor of the circuit (4) 5.4.4 The capacitance of the capacitor required for the circuit to be at resonance if the frequency of the supply in FIGURE 5.1 is constant at 1 kHz and the inductance is also constant (3) **[20]**
	Typical Questions ***Question 5: RLC*** 5.1 Distinguish between the *reactance* and *impedance* in an RLC circuit. (4) 5.2 Explain what the phase angle indicates. (2) 5.3 FIGURE 5.1 shows the relationship between the inductive reactance and the capacitive reactance against frequency in an RLC series circuit. Answer the questions that follow.  **FIGURE 5.1: FREQUENCY RESPONSE CURVE** 5.3.1 Explain the effect of frequency on the impedance of the circuit at point A. (2) 5.3.2 Calculate the frequency at point A if the circuit included a 50 µF capacitor and a 0,1 H inductor. Given: C = 50 µF L = 0,1 H (3)

Typical Question

Question 5: RLC

5.1 State THREE factors that affect the impedance of an RLC circuit. (3)

5.2 Refer to the circuit in FIGURE 5.2 below and answer the questions that follow.

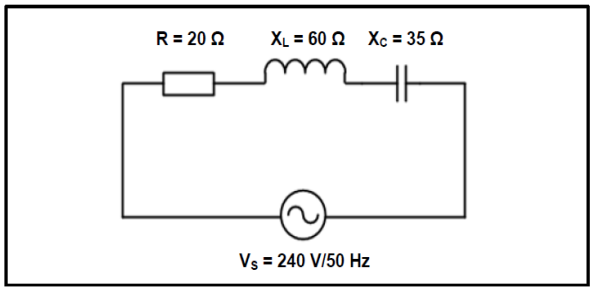


FIGURE 5.2: SERIES CIRCUIT

Given:

R = 20 Ω
X_L = 60 Ω
X_C = 35 Ω
V_s = 240 V
f = 50 Hz

5.2.1 State whether the power factor of the circuit is leading or lagging. (1)

5.2.2 Calculate the power factor of the circuit. (5)

5.2.3 Explain what will happen to the Q factor of an RLC series circuit if R, L and C are doubled. (3)

Typical Question

Question 2: RLC

2.1 Explain the phase relationship between current and voltage in the following AC circuits:

2.1.1 Resistive circuit (2)

2.1.2 Pure capacitive circuit (2)

2.1.3 Pure inductive circuit (2)

2.2 FIGURE 2.2 below shows an RLC series circuit, which consists of a 12 Ω resistor, a 30 mH inductor and a 150 µF capacitor, all connected across a 120 V/60 Hz supply.

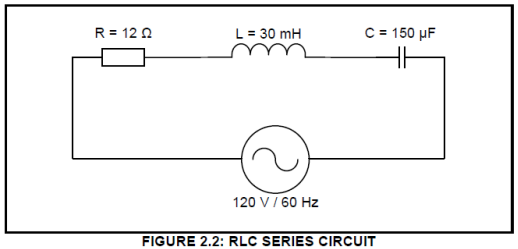
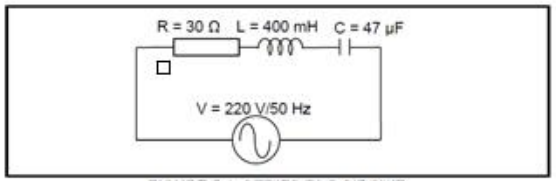
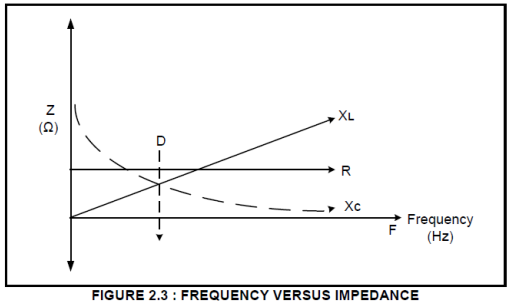


FIGURE 2.2: RLC SERIES CIRCUIT

Given:

R = 12 Ω
L = 30 mH
C = 150 µF
V_s = 120 V/60 Hz
f = 50 Hz

	Typical Questions ***Question 5: RLC*** 5.5 Refer to the circuit diagram in FIGURE 5.1.  **FIGURE 5.1: SERIES RLC CIRCUIT** Given: R = 30 Ω L = 400 mH C = 47 μF f = 50 Hz Calculate the: 5.5.1 Inductive reactance of the coil (3) 5.5.2 Capacitive reactance of the capacitor (3) 5.5.3 Frequency at which the circuit will resonate (3)	*Typical Questions* ***Question 2: RLC*** 2.3 Refer to FIGURE 2.3 and answer the questions that follow.  **FIGURE 2.3 : FREQUENCY VERSUS IMPEDANCE** 2.3.1 Describe how an increase in the frequency of the supply voltage will affect the: (a) Inductive reactance (2) (b) Capacitive reactance (2) 2.3.2 Explain why the response of line R is parallel to line F (2) 2.3.3 Name the electrical quantity that is equal to R at point D. (1)
ACTIVITIES/ASSESSMENT	***NB:*** *Please first do the questions on your own first, before consulting any resources* *Time per question (1 mark = 1 minute)* *Do the end of chapter activity -do all the questions related to this lesson. (page 20)*	
CONSOLIDATION	• *You have some good revision on series RLC circuits by working through relevant questions.* • *This lesson is all about consolidation of all the calculations that you have done to date on series RLC circuits.* • *Mastering calculations is all about practice and more practice* • *Well done with the completion of this lesson* • *Continue to become a specialist in what you love.* • *We no longer live in the era of pen pushers, but in that of the engineer, craftsman and specialist.*	The beautiful thing about learning is that no one can take it away from you. – B.B. King
VALUES	*It is important that you have perseverance when you do consolidation work. If at first you do not succeed, try, try and try again.*	