



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRICAL ENGINEERING-STAGE 3

EEC416- PRINCIPLES OF AC CIRCUITS

FINAL EXAMINATION – QUARTER 3, 2019

DURATION – 2 HOURS AND 10 MINUTES

TOTAL MARKS – 100

TOTAL NUMBER OF PAGES - 4

DAY/DATE: As per ETT

INSTRUCTIONS TO STUDENTS

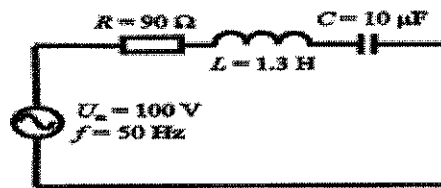
1. *You are allowed 10 minutes Extra reading time during which you are NOT to write.*
2. *Begin each answer on a fresh page and use both sides of the sheet.*
3. *Write your candidate-number at the top of each attached sheet*
4. *Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string*
5. *For all sheets of paper on which rough/draft work has been done, cross it though and you MUST ATTACH to your answer scripts.*
6. *Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
7. **ANSWER ALL QUESTIONS.**
8. *Show all workings where necessary.*
9. *Do not use programmable calculators, especially the ones that does the conversions of number systems.*
10. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

SECTION A**AC CIRCUITS AND RESONANCE****[35 MARKS]**

1. Draw the waveforms phasor diagram of the following: (9 marks)
 - A. Purely Resistive circuit
 - B. Purely Capacitive circuit
 - C. Purely Inductive circuit

2. Explain the relationship between the following with the aid of a graph: (4 marks)
 - A. Inductive reactance and frequency (X_L vs F)
 - B. Capacitive reactance and frequency (X_C vs F).

3. The circuit shown below is connected to a 100V, 50Hz supply. Determine: (6 marks)
 - A. the impedance of the circuit
 - B. the current flowing
 - C. the phase angle.

**Figure 1**

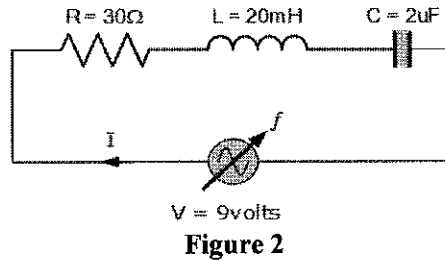
4. Determine the capacitive reactance of a capacitor of $10\mu\text{F}$ when connected to a circuit of frequency:
 - A. 50 Hz (1 mark)
 - B. At which frequency would it have a reactance of 20Ω . (2 marks)

5. A coil has a resistance of 4Ω and an inductance of 9.55mH . Calculate:
 - A. The reactance (1 mark)
 - B. The impedance (2 marks)
 - C. The current taken from a 240V, 50Hz supply (2 marks)
 - D. The phase angle between the supply voltage and current. (2 marks)

Please turn over

6. For the series resonance circuit above calculate the following:

- A. Resonant frequency (f_r) (2 marks)
- B. Circuit current at resonance (I_m) (1 mark)
- C. Inductive reactance at resonance. (X_L) (1 mark)
- D. Voltage across inductor (1 mark)
- E. Voltage across capacitor (1 mark)



SECTION B

POWER, PF AND THREE PHASE SYSTEMS

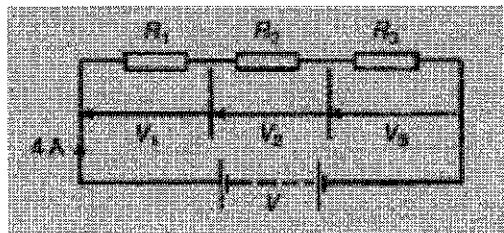
[35 Marks]

1. With the aid of diagrams show the construction of three phase waveform? (5 marks)
2. List down two advantages of three phase system over single phase system (4 marks)
3. A 80 W fluorescent lamp ballast typically has a resistance of 12Ω draws 0.8 A current and consumes 12W. Calculate: (4 marks)
 - A. power loss due to windings
 - B. Iron loss
4. In your own words define power factor. (4 marks)
5. Draw and correctly label the diagram of a power triangle. (5 marks)
6. If a 2KW load is connected to a 240 V ac supply. Find the current flowing at: (6 marks)
 - A. unity power factor ($\phi = 0^\circ$)
 - B. power factor is 0.8
 - C. power factor is 0.4
7. Outline (5) five effects of low power (5 marks)
8. State two methods of improving the power factor. (2 marks)

Please turn over

SECTION C**TRANSFORMERS AND NETWORKS****[30 MARKS]**

1. Name the three (3) types of transformers. **(3 marks)**
2. A transformer has 1200 turns on the primary winding and 120 turns on the secondary winding. If the applied voltage is 240 V calculate the output voltage of the transformer. **(3 marks)**
3. Show the primary and secondary winding polarity and the standard terminal arrangement of a single phase transformer. **(6 marks)**
4. State the equation required to determine the *efficiency of a transformer* in terms of the copper and iron losses with all its parameters. **(3 marks)**
5. List the three (3) colors which assists in the removal of heat from transformer casings and oil. **(3 marks)**
6. List the (7) information and Data shown on a transformer nameplate. **(7 marks)**
7. For the circuit shown, determine:
A. The battery voltage
B. The total resistance of the circuit
C. The values of R_1 , R_2 and R_3 , given that the voltage drop across R_1 , R_2 , and R_3 are 5V, 2V and 6V respectively. **(5 marks)**

**Figure 3****The End**