FIJI NATIONAL UNIVERSITY

COLLEGE: COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL: SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAMME: CERTIFICATE III IN ELECTRICAL ENGINEERING-STAGE 3

UNIT CODE: EEC332

TITLE: ELECTRICAL TRADE PRINCIPLES II

FINAL EXAMINATION – QUARTER 3, 2019

ROOM: AS PER TIMETABLE
TIME: 2 HOURS 10 MINUTES

INSTRUCTIONS TO STUDENTS

1. You are allowed **10 minutes** extra **reading time** during which you are **NOT** to write.
2. Begin each SECTION 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 a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. **ANSWER ALL QUESTIONS**
9. Show all working where necessary.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM.**

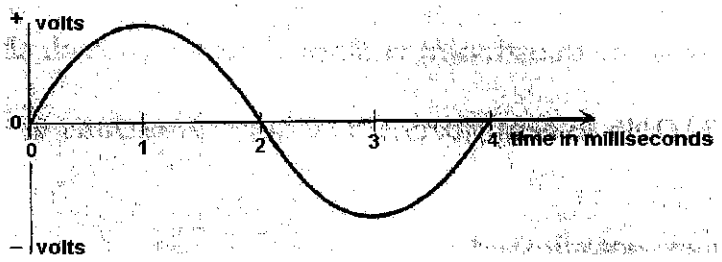
SECTION A MULTIPLE CHOICE (10 MARKS)

Choose the appropriate answer from each question by writing the alphabet beside the question number:

1. For a series circuit, the_____ is used as a reference phasor.
   A. voltage
   B. current
   C. power
   D. inductor

2. In a purely capacitive circuit connected to an alternating sinusoidal source:
   A. current leads voltage by 90°.
   B. voltage leads current by 90°.
   C. current lags voltage by 90°.
   D. voltage and current are in phase.

3. The frequency of the waveform shown below is:



   A. 0.25 Hz
   B. 25 Hz
   C. 250 Hz
   D. 4 Hz

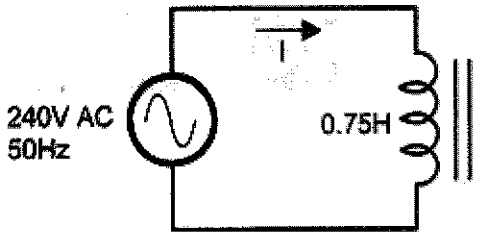
4. " ⟶ " is used to represent the phasor diagram for:
   A. resistor
   B. power
   C. current
   D. voltage

5. A force of 100 N is required to move a box 5 m along a horizontal surface. What is the value of work done?
   A. 100 joules
   B. 20 joules
   C. 0 joules
   D. 500 joules

6. Three inductors of 10mH, 40mH and 50mH are connected together in a series combination with no mutual inductance between them. Calculate the total inductance of the series combination?
   A. 100 mH
   B. 6.90 mH
   C. 0.145 mH
   D. 0 mH

7. The _____ of a substance is the amount of energy required to raise the temperature of 1 kg of the substance by 1°C.
   A. mole
   B. heating effect
   C. specific heat capacity
   D. specific power capacity

8. A coil of negligible resistance and an inductance of 0.75H are connected across 240V ac 50Hz. What is the inductive reactance (X_L) of the circuit?



   A. 100Ω
   B. 235.6Ω
   C. 0Ω
   D. 9000Ω

9. A single-phase motor draws 2.7 A on 240 V and a wattmeter in the circuit reads 486 W. What is the power factor?
   A. 0.5
   B. 0.75
   C. 0
   D. 1

10. The maximum e.m.f generated in an alternator coil is 200 V. What is the instantaneous voltage at 30°.
   A. 100 V
   B. 0 V
   C. 30 V
   D. 200 V

SECTION B [30 Marks]

1. Energy exists in various forms. List down three examples of energy existence. (3 marks)
2. Describe the phase relationship between V and I in a purely resistive, purely inductive and purely capacitive circuits? (3 marks)
3. Calculate the energy required to increase the temperature of 2kg of water from 20°C to 100°C. The specific heat capacity of water is 4200 J/kg °C. (2 marks)
4. An alternating voltage is represented by the expression v = 35 sin 314.2t volt. Determine:
   a). the maximum value (1 mark)
   b). the frequency (2 marks)
   c). the period of the waveform (2 marks)
   d). the value 3.5ms after it passes through zero, going positive. (3 marks)
5. The field windings of a generator have a resistance of 125Ω at a temperature of 20^0C. What will be the resistance of the windings when the machine temperature rises on full load to 60^0C.Note: The temperature coefficient of copper is 0.00427. (5 marks)
6. Draw the phasor diagram for the following:
   a) Series R-C circuit (2 marks)
   b) Series R-L circuit (2 marks)
   c) Series R-L-C circuit (2 marks)
7. A circuit with inductance value of 0.15 henry, resistance value of 25Ω and capacitance value of 100μF is connected to a 240 volt, 50Hz supply. Determine the impedance of the circuit. (3 marks)

SECTION C [30 Marks]

1. An inductor has a resistance of 30Ω and an inductance of 0.8H. If it's connected across a 240V 50Hz supply, find:
   a) its inductive reactance (2 marks)
   b) its impedance (2 marks)
   c) the current flowing through the inductor (2 marks)
   d) the phase angle between the current and the applied voltage (2 marks)
   e) draw the phasor diagram for current and voltage. (2 marks)
2. Explain what you understand about the term "power factor". (2 marks)
3. Describe two causes of low power factor. (2 marks)

4. A system running at a low power factor increases the current, which in turn leads to other disadvantages. Give two methods to improve power factor. (3 marks)

5. Describe one danger if resonance occurs in electrical installation. (2 marks)

6. What are the two major characteristics of the series resonant circuit? (2 marks)

7. Find the capacitive reactance of an 8μF capacitor and the current flowing when it is connected to a 100V 50 Hz supply. (4 marks)

8. True Power, apparent power and reactive power can be represented by a power triangle. Draw and label the power triangle. (5 marks)

SECTION D **[30 Marks]**

1. Describe four advantages of a three phase system over single-phase. (4 marks)

2. Draw the phasor diagram for a three phase system. (3 marks)

3. Name the two types of three-phase connection in a three-phase system? (2 marks)

4. Compare between star and delta systems in terms of the following:

   i) V_L (2 marks)
   ii) I_L (2 marks)
   iii) suitability of their usage (2 marks)

5. When is the loading on three-phase system said to be balanced? (2 marks)

6. State 2 advantages of using one wattmeter (four-wire system) for measuring power. (2 marks)

7. Three-coil each having a resistance of 28Ω and an inductive reactance of 35Ω are connected in delta to a 415V, 3 phase supply. Determine:

   a) Phase current (3 marks)
   b) Line current (2 marks)
   c) Power factor (3 marks)
   d) Total power (3 marks)

**********THE END**********

Formula Sheet

$X_L = 2\pi fL$

$$X_C = \frac{1}{2\pi fC}$$

$V = I\,R$
$V = I\,X_C$
$V = I\,X_L$
$W = 2\pi f$

$$F = \frac{1}{t}$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$Z = \sqrt{R^2 + X_L^{\,2}}$$

$$Z = \sqrt{R^2 + X_C^2}$$

$\text{Tan } O = X_L/R$

$\text{Tan } O = X_C/R$

$\text{Tan } O = X_L - X_C/R$

$Q = mc\Delta T$

$R_1 = R_0(1 + \alpha T_1)$
$R_2 = R_o\,(1 + \alpha T_2)$

$P = VI\lambda$

$S = VI$

$Q = VI \sin O$

$\lambda = \text{Cos } O = P/S$