

**FIJI NATIONAL UNIVERSITY****COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)****SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING****CERTIFICATE IV IN ELECTRICAL ENGINEERING  
STAGE 3****EEE391- ELECTRICAL PRINCIPLES (TRADE) 2****TIME ALLOWED- 2 HOURS + 10 MINUTES READING****FINAL EXAMINATION – PENSTER 3, 2013****INSTRUCTIONS TO STUDENTS**

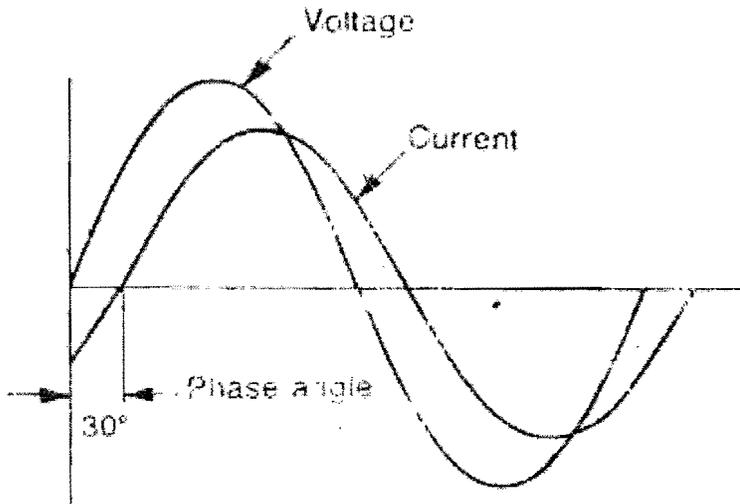
1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each answer on a fresh page and use both sides of the sheet.
3. Write your candidate-number at the top of each attached sheet
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct 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 do the conversions of number systems.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!**

**SECTION A**

[25 MARKS]

1. For the graph given below, complete the following sentence:

The figure below shows the \_\_\_\_\_ lagging the \_\_\_\_\_ by \_\_\_\_\_.  
(1.5 marks)



2. Two voltages A and B are connected in series. Voltage A is 150 V and leads the current by  $45^\circ$ ; voltage B is 100 V and lags the current by  $30^\circ$ . Find the total e.m.f and phase angle.  
(4 marks)

3. An inductor has a resistance of  $30\Omega$  and an inductance of 0.8H. If it's connected across a 240V 50Hz supply, find:

- a) its inductive reactance (1 mark)
- b) its impedance (1 mark)
- c) the current flowing through the inductor (1 mark)
- d) the phase angle between the current and the applied voltage (1 mark)
- e) draw the phasor diagram for current and voltage. (1 mark)

4. Energy exists in various forms. List down three examples of energy existence.(1.5 marks)

5. What is the phase relationship between V and I in a *purely resistive* and *purely capacitive* circuits?  
(2 marks)

6. Draw the phasor diagram for the following:

- a) Series R-C circuit (1 mark)
- b) Series R-L circuit (1 mark)
- c) Series R-L-C circuit (1 mark)

7. An aluminium pan of mass 0.5 kg containing 0.75 kg of water is heated from 20°C to 100°C. How much heat energy has been received by the pan and its contents? Note the specific heat capacity (in J/Kg.K) for aluminium is 900 and water is 4180.(3 marks)
8. 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, the current flowing and the phase angle. (5 marks)

**SECTION B****[25 MARKS]**

1. List down two causes of low power factor. (3 marks)
2. 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)
3. A single phase motor draws 2.7A on 240 V and a wattmeter in the circuit reads 486 W. Find the power factor. (4 marks)
4. Give one danger if resonance occurs in electrical installation. (2 marks)
5. What are the two major characteristics of the series resonant circuit? (2 marks)
6. True Power, apparent power and reactive power can be represented by a power triangle. Draw and label the power triangle. (5 marks)
7. Find the capacitive reactance of an 8μF capacitor and the current flowing when it is connected to a 100V 50 Hz supply. If it is then connected in series with another capacitor of the same capacity, find the new current flowing. (5 marks)

**SECTION C****[25 MARKS]**

1. Give three advantages of a three phase system over single-phase. (3 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. Three-coil each having a resistance of  $28\Omega$  and an inductive reactance of  $35\Omega$  are connected in delta to a  $415\text{V}$ , 3 phase supply. Determine:
- a) Phase current (3 marks)
  - b) Line current (2 marks)
  - c) Power factor (2 marks)
  - d) Total power (2 marks)

**SECTION D****[25 MARKS]**

1. Three identical Coils, each with resistance of  $15\Omega$  and inductance of  $52\text{mH}$  are connected in Star to  $415$  volts,  $50\text{Hz}$ , three phase supply. Calculate the following:
- a). Inductive Reactance of each coil (2 marks)
  - b). Impedance of each phase (2 marks)
  - c). Phase current (2 marks)
  - d). Line current (2 marks)
  - e). Power (3 marks)
2. The field windings of a generator have a resistance of  $125\Omega$  at a temperature of  $20^\circ\text{C}$ . What will be the resistance of the windings when the machine temperature rises on full load to  $60^\circ\text{C}$ . Note: The temperature coefficient of copper is  $0.00427$ . (5 marks)
3. An alternating voltage is represented by the expression  $v = 35 \sin 314.2t$  volt. Determine:
- a). the maximum value (2 marks)
  - b). the frequency (2 marks)
  - c). the period of the waveform (2 marks)
  - d). the value  $3.5\text{ms}$  after it passes through zero, going positive (3 marks)

\*\*\*\*\*THEEND\*\*\*\*\*