

**SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**

**TRADE DIPLOMA IN ELECTRICAL ENGINEERING**

**EEE431 – ELECTRICAL PRINCIPLES 2B**

**FINAL EXAMINATION – SEMESTER 2, 2013**

**DAY/DATE: As timetabled    DURATION : Three hours**

**ROOM: As timetabled**

**INSTRUCTION TO STUDENTS**

1. You are allowed 10 minutes extra reading time during which you are **NOT** to write.
2. Answer **ALL** sections
3. **Begin** the answer to each Question on a fresh page and use both sides of the sheet.
4. Write clearly the number of the question attempted on the top of each sheet
5. Write your candidate number at the top of each sheet & attach them.
6. Insert all written foolscaps, graph paper etc. in their correct sequence and secure with a string.
7. All sheets of paper on which rough/draft work has been done, cross it through and attach all of them to your answer scripts.

## SECTION A

1.
  - a) State the Faradays law of electromagnetic induction.
  - b) Based on the above law what are the two basic types of alternators that are built?
  - c) Discuss the main advantages of one type over the other type of alternator?  
[5 marks]
  
2.
  - a) What is the purpose of the slip rings in an alternator?
  - b) What component causes a generator to produce dc voltage rather than ac voltage at its output terminals?
  - c) In the above component, at what instant should the contact change to produce the dc voltage?  
[5 marks]
  
3. The mains supply in buildings in Fiji is normally 240 V r.m.s.
  - a) Calculate the peak voltage.
  - b) Calculate the average voltage.  
[2 marks]
  
4.
  - a) Discuss the factors that determine the frequency of the output voltage of an alternator?
  - b) An alternator having two poles produces a.c. at 50Hz. Calculate the rpm of the rotor.
  - c) If the number of poles is increased to 12, calculate the new rpm to maintain the frequency as 50 Hz.  
[5 marks]
  
5.
  - a) In a polyphase ac generator, explain how the desired phase relationship between the different voltages achieved?
  - b) Figure A5 represents the connections of a two-phase, three-wire alternator. How many voltage outputs are available from the two-phase three-wire alternator?
  - c) If the phase voltage of each coil is 240V, what are the output voltages of this alternator?
  - d) Using the same axes, draw and indicate the different voltage waveforms.

[8 marks]

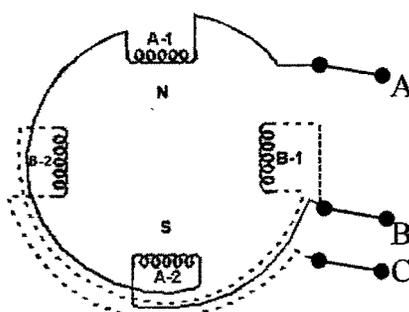


Figure A5

## SECTION B

1. a) In a laboratory measurement, a choke ( $L$ ), a resistor ( $R$ ) and an a.c. supply of voltage  $V$  were all connected in series. A current ( $I$ ) flows in the circuit. Is  $I$  leading or lagging the  $V$ . On the same axes, plot the variation of  $I$  and  $V$  and mark them clearly.  
[2 marks]
- b) The choke is now replaced by a capacitor ( $C$ ). Is  $I$  leading or lagging the  $V$ . On the same axes, plot the variation of  $I$  and  $V$  and mark them clearly.  
[2 marks]
- c) State what will be observed to the phase angle between  $I$  and  $V$ , if the  $L$ ,  $C$  and  $R$  are all connected in series with the a.c. source.  
[1 mark]
  
2. A single-phase induction motor connected across 240 V, 50Hz draws a current of 15A and the phase difference between the voltage and current is  $56^\circ$ . Calculate the *apparent power*, *true power* and the *reactive power*. Represent them on a *power triangle* with their units.  
[5 marks]
  
3. Two machines in a factory are supplied from the same 240V a.c. mains. One machine takes a current of 80 A at a power factor of 0.81. The other machine takes a current of 25A at a power factor of 0.60. Calculate the total current consumed by the factory.  
[5 marks]
  
4. a) Briefly explaining the reasons, state two negative effects of low power factor of an a.c circuit  
[2 marks]
  
- b) A lighting circuit draws a current of 16 A at 0.6 power factor from a 240 V, 50 Hz supply. Draw a phasor diagram representing the supply voltage and current. The recommended minimum power factor is 0.8. What is the minimum size of capacitor when connected in parallel with the load will improve the power factor to 0.8? If a circuit breaker is to be installed, what is the minimum current rating of the circuit breaker?  
[8 marks]

## SECTION C

1.
  - a) State two advantage of a three phase system.
  - b) Most large alternators have a small dc generator built into them. What is its purpose?
  - c) How is the variation in voltage of an alternator with load is measured and explain briefly how this may be controlled?
  - d) Explaining the reason state how are alternators usually rated?

[5 marks]

2. A 3 phase *Star* connected alternator coils (A, B, C) are represented in Figure C2. "S" and "F" on the coils denote the "start" and "finish" ends of the coils. The phase voltage of each coil is 240 V.

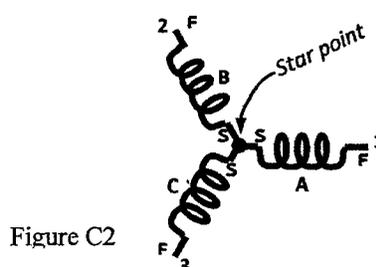


Figure C2

- a) A voltmeter when connected across which pairs of points will show 240 V?
- b) Calculate the line voltages?
- c) Practically, across which pairs of points should voltmeters be connected to the measure the line voltages?

When the alternator was dismantled and reassembled, by mistake the coil **A** was reversed.

- d) Redraw this arrangement of the coils.
- e) Explain how you will be able to identify the mistake in the reassembly by measurements?
- f) How much will be this *error* reading?

[13 marks]

3.
  - a) Three equal resistive loads of  $25 \Omega$  are connected in a *Delta* and fed by a three phase source. Each line current is 28.75 A. Draw this connection and calculate the current passing through each load.

[3 marks]

- b) Calculate the total power dissipated by the load.

[2 marks]

- c) Calculate the line voltages.

[2 mark]

## SECTION D

1. The currents drawn by the load in a three-phase, four wire unbalanced distribution system are:

Red phase	50 A at 0.79 power factor lagging
White phase	85 A at 0.85 power factor lagging
Blue phase	60 A at unity power factor.

Draw the phasor diagram and calculate the current in the neutral wire.

[5 marks]

2. In a balanced Delta - Wye system shown in Figure D2, each load is  $1.5\text{k}\Omega$  and the phase voltage of the source coil = 7.97 kV.

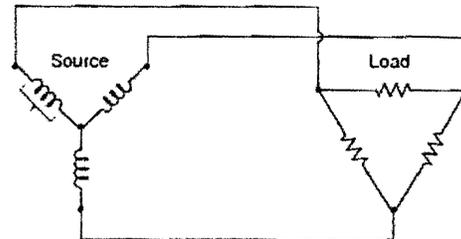


Figure D2

Calculate:

- Line voltages.
  - Phase voltage of each the Load.
  - Phase current of each the load.
  - Total power Supplied by the source.
  - Line current.
- [10 marks]
3. a) A 240/120 V single phase step down transformer has 960 turns on its primary winding. Calculate the number of turns required on the secondary winding. If a load of  $25\ \Omega$  is connected to the secondary, calculate the secondary and the primary currents.  
[3 marks]
- b) Discuss the two important media for transformer cooling?  
[2 mark]
- c) State the different types of transformer connection used in three-phase transmission and draw one type of connection  
[3 marks]
- d) Define *voltage regulation* in a transformer?  
[2 marks]

**THE END**