FNU FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

ELECTRICAL SERVICEMAN'S COURSE

EEE221- APPLIED ELECTRICITY 2

FINAL EXAMINATION – PENSTER 3, 2014

DAY/DATE: TIME: ROOM: As per Timetable.

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. <u>ANSWER ALL QUESTIONS</u>.

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   Multiple Choice   [10 Marks]

Choose the appropriate answer from each question and write it beside the number in your answer booklet.

1. A transformer has

A	primary and secondary windings, both of which are considered inputs
B	primary and secondary windings, both of which are considered outputs
C	a primary winding used as an output and a secondary winding used as an input
D	a primary winding used as an input and a secondary winding used as an output

2. When does ***maximum power transfer*** happen from the source to the load?

A	When the source resistance is greater than the load resistance
B	When the source resistance is less than the load resistance
C	When there is negligible source resistance
D	When the source resistance equals the load resistance

3. A transformer is plugged into a 120 V rms source and has a primary current of 300 mA rms. The secondary is providing 18 V across a 10 Ω load. What is the efficiency of the transformer?

A	88%	B	90%
C	92%	D	95%

4. Increasing the number of turns of wire on the secondary of a transformer will

A	increase the secondary current
B	decrease the secondary current
C	have no effect on the secondary current
D	increase the primary current

5. In a three-phase system, the voltages are separated by

A	45°	B	90°
C	120°	D	180°

6. In a balanced three-phase load, each phase has

A	an equal amount of power
B	one-third of total power
C	two-thirds of total power
D	a power consumption equal to $\sqrt{3V_L}\, I_L$

7.The most common type of ac motor is the

A	single-phase induction motor
B	two-phase induction motor
C	three-phase induction motor
D	two-phase *squirrel-cage* motor

8. In a Y-Y source/load configuration, the

A	phase current, the line current, and the load current are all equal in each phase
B	phase current, the line current, and the load current are 120° out of phase
C	phase current and the line current are in phase, and both are 120° out of phase with the load current
D	line current and the load current are in phase, and both are out of phase with the phase current

9. In a power supply diagram, which block indicates a smooth dc output?

A	transformer	B	filter
C	rectifier	D	regulator

10.If the frequency of the applied ac signal to a half-wave rectifier is 60 Hz, the frequency of the pulsating dc output will be

A	30 Hz
B	60 Hz
C	90 Hz
D	120 Hz

Section B   TRUE OR FALSE   [10 marks]

State true or false for the following questions in the answer booklet

1. In a 3 phase delta system, the apparent power is $\sqrt{3} \, V_L \, I_L \cos \emptyset$.

2. In a 3 phase, 3 wire unbalanced load power cannot be measured by 2 Wattmeter method.

3. In a 3 phase star connected system IP $=\sqrt{3} \, I_L$.

4. A single diode in a half-wave rectifier conducts for 180° of the input cycle.

5. A diode conducts current when reverse-biased and blocks current when forward-biased.

6. KW = KVA x cos Ø.

7. For the same size, the rating of 3 phase motor will be 1.5 times of a single phase motor.

8. If voltage in a transformer is stepped-up to the secondary, current will be stepped-down by the same amount.

9. If the current drawn in the secondary of a transformer increases, the power in the primary should remain the same.

10. The Power Factor of a resistive load is Zero.

Section C   THEORY QUESTIONS   [80 Marks]

Question 1   3 PHASE SYSTEM   [20 Marks]

1. Draw the three phase waveform from 0 -360 degrees.   **(2 marks)**

2. What is the phase sequence of a three phase system?   **(2 marks)**

3. Name two types of three phase connections and draw the connection diagram for both.

(4marks)

4. Compare the two types of three phase connections. Mention at least four (4) points in each case.

(4 mark)

5. A three phase delta supply draws a phase current of 5 amperes from a 415, volt 50 HZ power supply. Determine the following:

a) Line voltage   **(1 mark)**

b) Phase voltage   **(1 mark)**

c) Line current   **(1 mark)**

d) Phase current: **(1 mark)**

6. A balanced star connected load of $(10 + j5)$ Ω per phase is connected to a 3 phase 415V supply. Find

a) Line Current   **(2 marks)**

b) Power factor   **(2 marks)**

Question 2   **THREE PHASE MOTOR**   **[20Marks]**

1. Name the two types of three phase rotor.   **(2 marks)**

2. Draw the bridging connection of a three phase star and delta motor.   **(4 marks)**

3. How can the rotation of a three phase motor can be changed?   **(2 marks)**

4. List Three (3) advantages of using a three phase motor.   **(3 marks)**

5. A star connected 415 volt three phase motor draws a phase current of 3.6 amperes. Determine the following:

a) Line voltage   **(1 mark)**

b) Phase voltage   **(1 mark)**

c) Line current   **(1 mark)**

d) Phase current: **(1 mark)**

6. Label the main components of the squirrel cage induction motor as shown below.
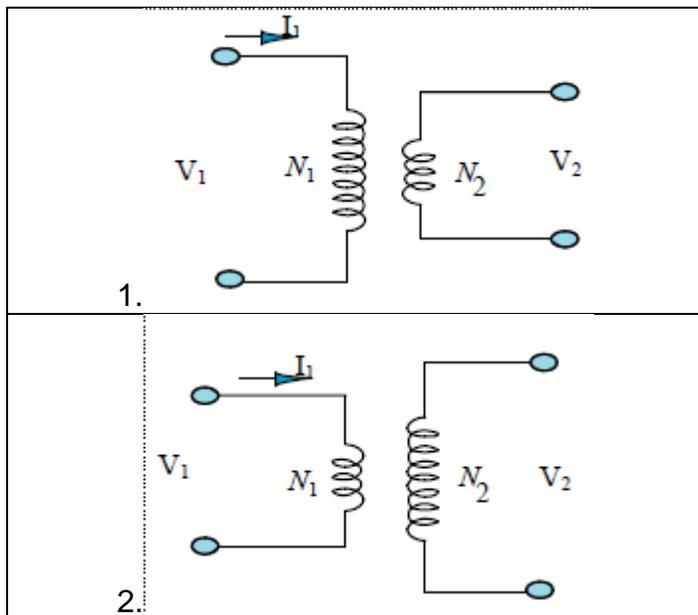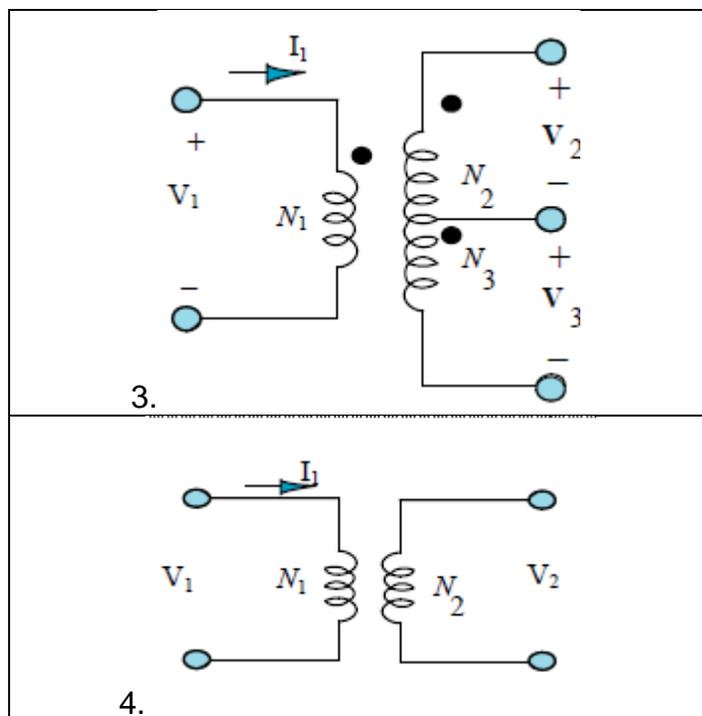   **(5marks)**
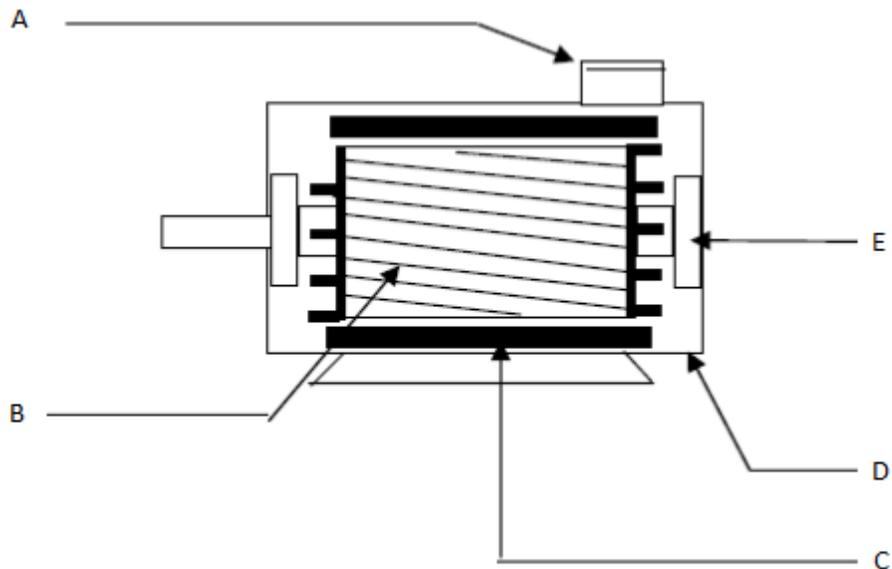
Question 3   TRANSFORMERS   [20 Marks]

1. State three (3) types of transformers.   **(3 marks)**

2. Show the internal connections of a three phase transformer connected in star and delta.
       (4 marks)

3. A transformer has 960 turns on its primary winding (N_P) and 48 turns on the secondary (N_S). Find the following:

a) Turns ratio of the transformer.   **(2marks)**

b) Secondary voltage when 240V is applied to the primary coil.   **(2marks)**

5. Name and explain two different methods of cooling transformers.   **(4 marks)**

6. State an application example of a transformer.   **(1 mark)**

7. Identify the types of transformer shown below.   **(4 marks)**

3.

4.

Question 4   RECTIFIERS   [20 Marks]

1. Draw the circuit diagram of the following rectifier circuits, sketching the input and output waveforms.

   a) Single phase half wave   **(3 marks)**
   b) Single phase bridge   **(3 marks)**
   c) Three phase full wave bridge   **(3 marks)**

2.Calculate the current (I_{DC}) flowing through a 100Ω resistor connected to a 240v single phase half-wave rectifier as shown above, and also the power consumed by the load?

                                                                 (4 marks)

3. In a single phase full wave centre-tap rectification, the AC voltage is 32 V at 50 hertz and load resistance of 5 Ω. Calculate the following:

a) The load voltage   **(1 mark)**

b) The load current   **(1 mark)**

c) the ripple voltage   **(2 marks)**

d)The ripple frequency   **(1 mark)**

e) The peak root value   **(2 marks)**

THE END