FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IN ELECTRCAL SERVICEMAN'S COURSE – STAGE 2

EEE 221 APPLIED ELECTRICITY 2

FINAL EXAMINATION – PENSTER 2, 2014

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, 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 through and you MUST ATTACH to your answer scripts.*

6. *Write clearly the number(s) of the question(s) attempted on 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 conversion of number systems.*

10. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM.***

ESC 2 – EEE 221 APPLIED ELECTRICITY2, FINAL EXAMINATION – PENSTER 2 [2014]

SECTION A (20 MARKS) MULTIPLE CHOICE.

QUESTIONS:

1. Current in the neutral conductor for any three phase four wire system is derived by the formula,
   A. $I_N = -(iR + iW + iB)$
   B. $I_N = (iR + iW - iB)$
   C. $I_N = -(iR + iW - iB)$
   D. $I_N = (iR + iW + iB)$ (1mark)

2. What is the effect of a broken neutral when the motor is connected and running?
   A. Motor runs at rated speed
   B. Motor runs at half speed
   C. Motor runs very slow and vibrate
   D. Motor stops   (1mark)

3. A single phase split phase motor has the following arrangements for its RUN windings.

   A. Run windings are connected in series with the centrifugal switch and start windings.
   B. Run windings are connected in series with the start windings and parallel with the centrifugal switch.
   C. Run windings are connected in series with the capacitor and the start windings.
   D. Run windings are connected in parallel with the start windings, the centrifugal switch and the capacitor are connected in series with the start windings.

                (1 mark)

4. If a 415 V, 3Ø transformer has 300 turns per phase and 60 turns in the secondaries, find the output line voltage.

   A. 83 V
   B. 140 V
   C. 144 V
   D. 48 V   (1 marks)

5. One of the requirements to be fulfilled in connecting 3Ø transformers in parallel is to have,

    A. Equal voltages and same phase shifts can be connected in parallel
    B. Non-compatible can be connected in parallel
    C. Different phase sequence can be connected in parallel
    D. Phase voltages with different phase shifts can be connected in parallel   (1 mark)

6. Transformation ratios for current and voltage is derived as,

    A. $\dfrac{V1}{V2} = \dfrac{N1}{N2}$

    B. $\dfrac{V1}{V2} = \dfrac{N1}{N2} = \dfrac{I2}{I1}$

    C. $\dfrac{V1}{V2} = \dfrac{N1}{N2} = \dfrac{I1}{I2}$

    D. $\dfrac{V2}{V1} = \dfrac{N2}{N1} = \dfrac{I1}{I2}$ (1 marks)

7. A capacitor start motor has a run and start windings, what is the right specification for the both windings?

    A. Run windings - heavy gauge wire and less turns, start windings –small gauge wire and more turns.
    B. Run windings - small gauge wire and more turns, start windings – heavy gauge wire and less turns.
    C. Run and start windings – same gauge wire, start windings - more turns than run windings.
    D. Run windings – heavy gauge wire and more turns, start windings – smaller gauge wire and less turns.   (1 mark)

8. For a balanced condition, the total power is still $3P = 3Vp.Ip . \cos\emptyset$
   In a delta system $V_L = V_p \ and \ I_L = \sqrt{3}.Ip$ substituting these then,

    A. Total power$= 3V_L\,{}^{I_L}\!\big/_{\sqrt{3}}\sin\emptyset$

$$= \sqrt{3}.Vp.Ip.sin\emptyset$$

Cont…

B. Total power= $3Vp.\frac{Ip}{\sqrt{3}}\cos\emptyset$

$$= \sqrt{3}.Vp.Ip.\cos\emptyset$$

C. Total power= $3V_L.\sqrt{3}.Ip.\cos\emptyset$

$$= \sqrt{3}.3V_L.Ip.\cos\emptyset$$

D. Total power= $3V_L.\frac{I_L}{\sqrt{3}}.\cos\emptyset$

$$= \sqrt{3}.V_L.I_L.\cos\emptyset$$ (1 marks)

9. What is the synchronous speed of a two pole motor on a 50 Hz frequency supply?

    A.   2800 r. p. m.
    B.   2950 r. p. m.
    C.   3000 r. p. m.
    D.   1500 r. p. m.

(1 marks)

10. The auto-starters (using three auto transformers) can be used to start cage induction motor of the following type
    A. Star connected only
    B. Delta connected only
    C. (a) and (b) both
    D. None of the above   (1 mark)

11. The number of slip rings on a squirrel cage induction motor is usually
    A. Two
    B. Three
    C. Four
    D. None   (1 mark)

12. Star-delta starting of motors is not is not possible in case of
    A. Single phase motors
    B. Variable speed motors

Cont…

    C. Low horse power motors

    D. High speed motors   (1 mark)

13. An induction motor with 1000 r.m.p. speed will have

    A. 8 poles

    B. 6 poles

    C. 4 poles

    D. 2 poles   (1 mark)

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

    A. 450°

    B. 90°

    C. 120°

    D. 180°   (1 mark)

15. In a three-phase system, when the loads are perfectly balanced, the neutral current is

    A. Zero

    B. One thirds of maximum

    C. Two thirds of maximum

    D. At maximum   (1 mark)

16. A three-phase 440 V, 50 Hz induction motor has 4% slip. The frequency of rotor e.m.f. will be

    A. 200 Hz

    B. 50 Hz

    C. 2 Hz

    D. 0.2 Hz   (1 mark)

17. In a transformer

    A. All turns are equally insulated

    B. The end turns are more strongly insulated

    C. The end are closely wound

    D. The end turns are widely separated   (1 mark)

18. Oil in transformer is used to

    A. Transfer electrical energy

    B. Insulate the winding

    C. Cool the winding

    D. None of the above   (1 mark)

19. The winding of the transformer are divided into several coils because
    A. It is difficult to wind as one coil
    B. It reduces voltage per coil
    C. It requires less insulation
    D. None of the above   (1 mark)

20. The efficiency of a transformer is usually in the range of
    A. 50 – 60%
    B. 65 – 75%
    C. 70 – 90%
    D. 90 -98%   (1 mark)

ESC2 - EEE 221, APPLIED ELECTRICITY 2, EXAMINATION PAPER– PENSTER 2 [2014]

SECTION B (30 MARKS) BRIEF ANSWERS.

QUESTIONS:

1. Define current in the neutral conductor for a three phase four wire
star connection.   (2 marks)

2. What are the two requirements for a balanced load?   (2 marks)

3. List four of each comparisons between star and delta systems   (8 marks)

4. Explain the construction of motor stator and the windings on it.   (3 marks)

5. Describe a squirrel cage rotor construction on its core, rotor conductors
and shaft for large and medium motors.   (3 marks)

6. Briefly explain the RUN and START windings of a single phase split phase
motor.   (4 marks)

7. List and explain three parallel requirements for a three phase transformer.   (6 marks)

8. Briefly explain the action of rectification.   (2 marks)

ESC2-EEE 221 APPLIED ELECTRICITY2 FINAL EXAMINATION – PENSTER 2 [2014]

SECTION C (50 MARKS) CALCULATIONS.

QUESTIONS:

1. What size capacitor would be needed to give adequate filtering for a
   $150\,\Omega$ load on 220V d.c., assuming the ripple frequency was 50 Hz?   (5 mark)

2. Determine the rotor frequencies for (a) four pole and (b) a two pole, 50 Hz
   Induction motors with rotor speeds of 1450 r.p.m and 2900 r.p.m respectively.   (10 marks)

3. A transformer has 2000 turns in the secondary windings and 400 turns in the
   secondary winding. The supply voltage is 250V, calculate the output voltage
   of the transformer.   (5 marks)

4. A three phase, 415V transformer has the following:

   a. 400 turns on the primary windings
   b. 80 turns on the secondaries.
      Find the output line voltage for star – delta and delta – star connections.   (10 marks)

5. The transformer has the following parameters:
   a. 30 Ω non-inductive load
   b. 240 V a.c. power supply
   c. 120 V a.c. secondary
      Find the current flowing in the load and the current flowing into the
      transformer from the supply.   (6 marks)

6. What would be the speed of a prime mover driving an alternator which has
   twelve poles and a frequency of 60 Hz generated?   (4 marks)

7. A two pole induction motor is running at 2850 r.p.m when connected to
   50 hertz power supply, determine the synchronous speed, slip speed,
   percentage slip and rotor frequency.   (10 marks)

END