FNU FIJI NATIONAL UNIVERSITY

SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

TRADE DIPLOMA IN ELECTRICAL ENGINEERING (ELECTRICAL) – STAGE 5

EEE537-ELECTRICAL POWER TRANSMISSION & DISTRIBUTION

FINAL EXAMINATION – SEMESTER 2 -2016 DURATION: 3 HOURS

INSTRUCTIONS TO STUDENTS:

1. You are allowed 10 minutes extra reading time during which you are not allowed 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 answer sheet.
4. Insert all 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 through and you must attach to the answer booklet.
6. Write clearly the number(s) of the question(s) attempted on top of each sheet.
7. **ATTEMPT ALL QUESTIONS**

SECTION A

(40 MARKS)

1. Discuss at least two different conductor materials used in overhead line work. (4 marks)

2. Conductor vibrations cause a lot of havoc on overhead lines. With the aid of diagrams, discuss these vibrations. (8 marks)

3. Due to heavy loads experienced on transmission and distribution of electrical energy, bundle conductors are used. Outline the advantages and disadvantages of using bundle conductors. (6marks)

4. On long lines the capacitance effect cannot be ignored and because the circuit is very difficult to analyse, models are used. With the aid of diagrams outline the two models used to work out these parameters. (4 marks)

5. Explain the following types of effects on overhead lines:
   a. Ferranti effect
   b. Corona effect.

   (4 marks)

6. Differentiate between the three overhead line insulator materials. (3 marks)

7. Briefly discuss any three circuit breakers used in electrical systems. (3 marks)

8. Explain the Dy1 and Dy11 mode of connections on transformers and draw the two types of connections including the phasor diagrams. (6 marks)

9. Briefly discuss with the aid of diagrams any two types of line supports. (2 marks)

SECTION B

(60 MARKS)

1. Calculate the resistance, inductance and capacitance per phase of 40.5 km of overhead line having copper conductors of 1.85 cm diameter and:

   (a) Spaced with 1.45 m between adjacent centres in flat regular intervals

   (b) Spaced on corners of triangle having sides of 1.45 m, 1.65 m and 1.85 m.
   (Rho for copper = 1.71 micro ohm cm and conductors are transposed). (10 marks)

2. (a). Identify any four properties of transformer oil. (4 marks)

   (b). Outline any three of the standard markings on power transformers in as far as cooling and insulation is concerned. (3 marks)

   (c). Discuss the conditions to be met for parallel operation of three phase transformers (3 marks)

3. A string of three insulators is used to suspend one conductor of a 33 kV three-phase line. The air capacitance between each cap/pin junction to the tower is 1/20 the capacitance of each unit. Calculate the voltage across each insulator and also the string efficiency. (15 marks)

4. A three-phase, distribution system has the following:

   (a) Alternator 1a – 5 MVA, Reactance is 1.5 ohm per phase and generating at 3.3 kV.
   (b) Transformer 1 – 3 MVA, Reactance is 0.04 pu and output voltage of 6.6 kV.
   (c) The transmission line is 6.6 kV and has a Reactance of 0.4 ohm per phase.
   (d) Transformer 2 – 1.5 MVA, Reactance of 0.2 pu and output voltage of 11 kV.

   Draw the circuit and calculate the fault current if a three-phase symmetrical fault to earth occurs at the remote feeder. (15 marks)

5. A 6.6 kV, 50Hz 26.5 km single core lead sheath cable has a conductor of radius 2.5 cm and lead sheath radius of 5 cm and $\varepsilon r = 3$. Calculate the following:

(a) Total resistance of the copper (Rho copper = 1.71μΩ - cm)
(b) Inductance
(c) Capacitance
(d) Insulation resistance (Rho insulation = 1.3 x Exponential 8 MΩ-cm)
(e) Power loss.

(10 marks)

The End