MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

THIRD YEAR **FIRST** SEMESTER EXAMINATION FOR THE DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

SEE 1321 – POWER SYSTEMS I

DURATION: 2 HOURS

DATE: 18TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.
4. You should have a scientific calculator for this examination

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) Outline any four causes of low power factor in electrical systems (2 marks)

b) Explain three methods commonly applied to improve power factor to electrical systems.

(6 marks)

c) Briefly explain any four common forms of natural energy converted into electrical energy

(2 marks)

d) With the aid of a diagram, illustrate the process employed to derive electrical energy from natural sources (3 marks)

e) Explain four factors considered when selecting a site for construction of a hydro electric power station. (4 marks)

f) Define the term tariff as applied to consumption of electrical energy (2 marks)

g) State the components of each of the following costs of generating electrical energy

   i. Fixed costs

   ii. Running costs (4 marks)

h) Explain the term synchronization as applied to synchronous alternators (2 marks)

i) With the aid of a sketch, illustrate the construction of a cylindrical field winding of a synchronous alternator (5 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) (i) State any two types of electrical power generating plants found in Kenya (2 marks)

   (ii) Describe the operation of the following turbines when applied in generation of electrical energy

     – Pelton

     – Francis (4 marks)

b) Explain the operation of a nuclear power station (4 marks)

c) (i) State two types of excitation schemes applied to regulate the output of electrical energy.

(2 marks)

(iii) Explain the functions of the following components of excitation systems.

- Limiters and protective circuits

- D.C. regulators

d) A generating station has a maximum demand of 20MW and a load factor of 0.5. Determine the daily energy produced. (4 marks)

QUESTION THREE

a) (i) Outline any three advantages of a hydro electric power plant (3 marks)

(ii) With the aid of a single line diagram, illustrate the details of a transmission and distribution system of electrical energy from the source to the consumer. (6 marks)

b) (i) Explain how the field of an alternator is enhanced to derive higher terminal voltage

(2 marks)

(ii) Outline the conditions to be fulfilled before synchronous alternators can be connected in parallel to an existing supply. (3 marks)

(iii) With the aid of diagrams, explain three methods used to synchronize alternators

(6 marks)

QUESTION FOUR

a) State two advantages of suspension insulators over pin type insulators (2 marks)

b) Describe the following tests applied to overhead conductor suspension insulators. (6 marks)

   i. Dry flashover

   ii. Puncture

   iii. Porosity

c) A string of five insulators is used to suspend one conductor of a 33-KV, 3-Ø supply overhead transmission line. The air capacitance between each gap junction and the earth is $\frac{1}{10}$ of the capacitance of each unit. Calculate:

   i. The voltage across each insulator

   ii. The string efficiency (12 marks)