SECTION A

*Answer any **THREE** questions from this section.*

1. (a) (i) State **two** types of power generating stations in Kenya.
(ii) Describe the following turbines used in power generation:

(I) pelton;
(II) francis wheel. (6 marks)

(b) Explain the operation of a nuclear power station. (6 marks)

(c) (i) State **two** types of machine excitation schemes in use.
(ii) Explain the function of the following as used in excitation systems:

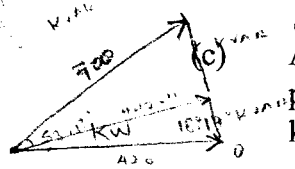
(I) limiters and protective circuits;
(II) d.c. regulator. (4 marks)

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

2. (a) (i) State **three** advantages of armoured PVC insulated cables over vulcanized rubber for power distributors.
(ii) Draw a labelled cross-section diagram of a three core paper insulated lead-sheathed belted cable. (11 marks)

(b) Outline **four** causes of low power factor. (4 marks)

(c) A substation transformer is supplying 420 kW at 0.6 power factor lagging. The power factor is improved using loss-free capacitors to 0.95 lagging at constant kilowatt.



(i) sketch the phasor diagram;
(ii) determine the leading KVAr required. (5 marks)

3. (a) State **two** components in each of the following cost of generating electrical energy:

(i) fixed cost;
(ii) running cost. (4 marks)

(b) Explain how the following factors affect power generation:

(i) diversity factor;
(ii) load factor. (6 marks)

(c) A 415 V, 2-core feeder cable 3 km long supplies a maximum current of 150 A and the demand is such that the copper loss per annum is such as would be produced by the full load current flowing in six months. The resistance of the conductor 1 km long and 1 cm^2 cross-sectional area is 0.170 Ω. The cost of the cable including installation is Ksh (150 A + 100) per meter where A is the cross-section area (cm^2) and interest and depreciation charges are 10%. The cost of energy is Ksh 3 per kWh. Determine the cross-sectional area of conductor. (10 marks)

4. (a) State **two** advantages of suspension type insulator over pin type insulator. (2 marks)

(b) Describe the following insulator tests:

(i) dry flashover;
(ii) puncture;
(iii) porosity. (6 marks)

(c) A string of five insulators is used to suspend one conductor of a 33-kV, three-phase, overhead transmission line. The air capacitance between each cap juction and the earth is one tenth of the capacitance of each unit. Calculte the:

(i) voltage across each insulator;
(ii) string efficiency. (12 marks)

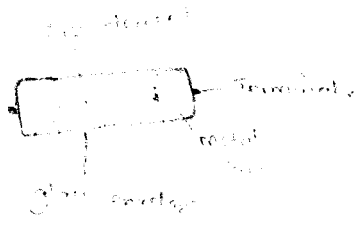
5. (a) State **three** advantages of sulphur hexaflouride over air blast circuit breakers. (3 marks)

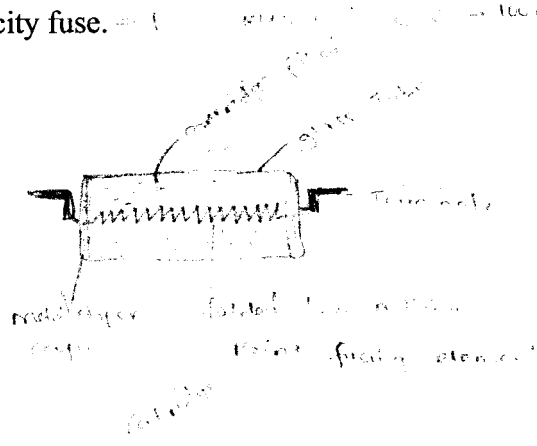
(b) Explain the principle of arc extinction in circuit breakers. (4 marks)

(c) Outline **three** types of short-circuits in electrical power systems. (3 marks)

(d) Draw labelled diagrams of the following:

(i) cartridge fuse;
(ii) high-rupturing capacity fuse. (10 marks)





SECTION B

*Answer any **TWO** questions from this section.*

6. (a) (i) With reference to lightning protection, explain how a lightning discharge occurs.

(ii) With the aid of a sketch, explain the term 'zone of protection'. (10 marks)

(b) State:

(i) the basic cause of corrosion;

(ii) **two** types of construction materials which cause corrosion. (4 marks)

(c) With aid of a diagram, describe impressed currents method of cathodic protection. (6 marks)

7. (a) Define the following:

(i) luminous intensity;

(ii) lumen. (2 marks)

(b) Using a diagram, derive the expression for the inverse square law used in illumination. (6 marks)

(c) Draw a labelled diagram of a high pressure mercury vapour lamp. (6 marks)

(d) Figure 1 shows two light sources of luminous intensity 120 candela and 240 candela. Determine the illumination midway between the lamps. (6 marks)

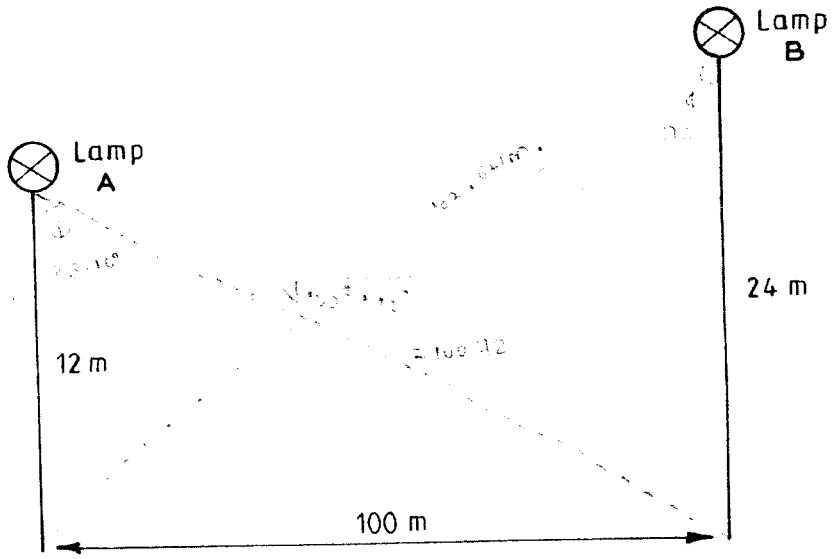


Fig. 1

8. (a) Outline **five** sources of hazards found in agricultural premises. (5 marks)

(b) Describe the following hazardous areas:

(i) division 0;
(ii) division 1;
(iii) division 2. (6 marks)

(c) Differentiate between caravan and superstructure of a building. (4 marks)

(d) State **five** types of residential drainage systems. (5 marks)

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