## SECTION A:

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

1. (a) State **three** regulations regarding switchgears at the consumer's intake point. (3 marks)

(b) Draw circuit diagrams of the following systems of distribution:

(i) A.C three-wire single phase;
(ii) D.C three-wire.

(10 marks)

(c) Draw a labelled line diagram of a typical national grid system in Kenya and indicate standard voltages at each level. (7 marks)

2. (a) State **three** methods for protecting an installation against earth leakage currents. (3 marks)

(b) Define the following terms as used in fuses:

(i) current rating;
(ii) fusing current;
(iii) discrimination

(6 marks)

(c) With the aid of a labelled circuit diagram, describe the operation of a current operated earth leakage circuit breaker. (11 marks)

3. (a) State any:

(i) **three** voltage classifications of consumer units;
(ii) **two** groups of final circuits. (5 marks)

(b) A domestic cooker is connected to a 230V supply and its load is 8.5kw. Determine the rating of the circuit. (6 marks)

(c) (i) Outline the procedure for selecting a cable for a particular application.

(ii) Explain how the following factors affect the rating of conductors:

(I) Diversity;
(II) Type of excess current protection;
(III) Thermal insulation.

(9 marks)

4. (a) Explain the significance of carrying out the following tests on a complete electrical installation:

(i) polarity,
(ii) earth electrode resistance.

(4 marks)

(b) Draw a labelled diagram of a consumer unit having a final circuit of a ring circuit with three socket outlets and a spur. Indicate the cable size and fuse rating.

(9 marks)

(c) With aid of a circuit diagram, describe the loop-in method in wiring a lighting circuit.

(7 marks)

5. (a) Describe with the aid of a labelled diagram the constructional futures of a d.c. machine.

(12 marks)

(b) Draw labelled circuit diagrams of the following electrical machines:

(i) Capacitor start, induction motor,
(ii) Compound wound motors.

(8 marks)

## SECTION B:

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

6. (a) Differentiate between photovoltaic effect and photo electric effect with regards to solar installation systems. (4 marks)

(b) (i) With the aid of a labelled diagram, explain the working principle of a solar cell.

(6 marks)

(ii) Explain with aid of a labelled block diagram function of each component part of a photovoltaic system. (10 marks)

7. (a) State **two**;

(i) disadvantages of solar cookers;
(ii) advantages of using solar water heaters.

(4 marks)

(b) Describe with the aid of a labelled diagram the construction of liquid flat plate collector.

(10 marks)

(c) Describe the following methods of pumping water using solar energy:

(i) Direct conversion scheme;
(ii) Thermodynamic conversion.

(6 marks)

8. (a) Define the following terms as applied in solar installation:

(i) Radiation;
(ii) Insulation.

(4 marks)

(b) State any **two**:

(i) Methods of solar energy harvesting
(ii) Applications of solar energy.

(4 marks)

(c) State **one** possible cause and remedy for the following solar installation:

(i) Battery state is low;
(ii) No solar charge.

(8 marks)

(d) Draw a labelled schematic diagram of a solar water heater.

(4 marks)