

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 completed 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 features 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)