

GENERAL CERTIFICATE OF EDUCATION BOARD
Technical and Vocational Education Examination

ELECTRICAL TECHNOLOGY AND DIAGRAM 2
5245

JUNE 2022

INTERMEDIATE LEVEL

Specialty Name and Acronym	ELECTRICAL POWER SYSTEMS – EPS(F3)
Subject Title	ELECTRICAL TECHNOLOGY AND DIAGRAM
Subject Code No.	5245
Paper No.	2

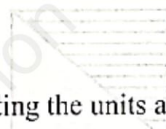
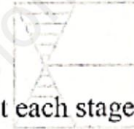
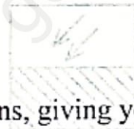
DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES

Section A has THREE Questions. Each question carries 30 Marks. ANSWER ANY TWO

Section B has THREE Questions. Each question carries 20 Marks. ANSWER ANY TWO

This paper has Two Sections A& B, and has a weighting of 35% of the whole subject.



Show all steps in your calculations, giving your answer at each stage and indicating the units and symbols used.

All sketches must be neat and clear.

You are allowed to use non-programmable calculators and mathematical sets.

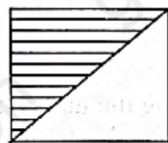
You are reminded of the necessity for good English and orderly presentation in your answers.

Turn Over

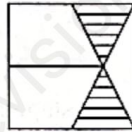
SECTION A: ELECTRICAL TECHNOLOGY

- 1) (a) Give the symbols of the following switch gears
- (i) One way switch (1 mark)
 - (ii) Two way switch (1 mark)
 - (iii) Tele switch (1 mark)
 - (iv) Fused isolator (1 mark)
 - (v) Three phase contactor (1 mark)
 - (vi) Three phase thermal relay (1 mark)
 - (vii) Three phase circuit breaker (1 mark)
- (b) Give the area of application of each of the switch gears listed above (7marks)
- (c) Draw and label all the parts of the following lamps:
- (i) An incandescent lamp (7 marks)
 - (ii) A fluorescent lamp (9 marks)
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- 2) (a) For an overhead power line, one can find the following items: 9m poles, 54mm² bare conductors, cross-arms and chain isolators. Explain the role of each of these items. (10 marks)
- (b) Identify the type of power stations from the symbols of figure 1 below and for each, state its primary source of energy. (10 marks)

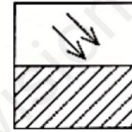
Figure 1



(i)



(ii)



(iii)

- (c) Distinguish between a substation and a generation station. (10 marks)

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- 3) (a) Name any five ways electrical energy can be produced (6 marks)
- (b) Cite any four types of renewable energy. (6 marks)
- (c) With respect to hydroelectric power plant, name three types of turbines. (6 marks)
- (d) With the aid of a diagram, explain how electrical energy is produced from a hydroelectric power plant (12 marks)

SECTION B: ELECTRICAL DIAGRAM

- 4) (a) State two disadvantages of low power factor to the consumer of electricity (3 marks)
- (b) Name two advantages of wound rotor motor over the squirrel cage induction motor. (3 marks)
- (c) State one reason why fuse with a striker is advantageous in a three phase system. (2 marks)
- (d) Draw the power and control diagrams of the star-delta starting method for starting three phase induction motors without direction of rotation. (12 marks)

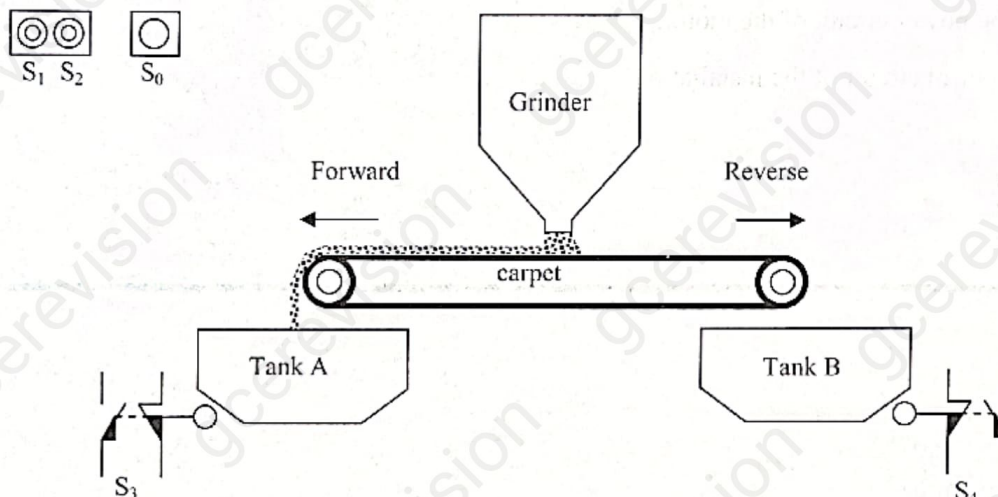
- 5) In order to prevent the waste of energy in a stair case, a landlord of a building needs that when the light circuit is put ON manually; it remains on for 10 minutes and then switches off automatically.

Work required:

- (a) Considering four control post and three lamps, protection ensured by circuit breaker, propose a developed diagram of this installation. **(15 marks)**
- (b) State one main advantage and one disadvantage of the controlling method above over the other methods. **(5 marks)**

6) HANDLING OF COFFEE

A- Description



B- Functioning

Powder coffee coming from the grinder falls on the carpet driven by a three phase induction motor.

An action on the push button S2 provokes the following operations:

- If tanks A and B are empty, the motor runs in the forward direction
- If tank A is empty, the motor runs in the forward direction
- If tank A is full, the motor runs in the reverse direction automatically
- If tanks A and B are full, the motor stops

An action on the push button S₁ or on the emergency button S₀ causes the system to stop in case of any undesired operation.

C- Signalling And Protection

Motor is direct-on line started and it is protected against over load and short-circuits.

The indicator lamps provide the following signals:

- H₁: Functioning of motor in forward
- H₂: Functioning of motor in reverse
- H₃: Tripping of the thermal relay protecting the motor
- H₄: Presence of supply voltage

D- AC Source

Three phase supply: 230 / 400V + N + PE

Control circuit supplied by: 230V

Turn Over

E- Nomenclature

Q: Three-phase isolator equipped with fuses and two breaks before open contacts

F₁: Fuse of type g^{II}

F₂: Protective thermal relay for motor

S₀: Emergency button

S₁: Stop push button

S₂: Start push button

S₃, S₄: limit switches of electro-mechanic type

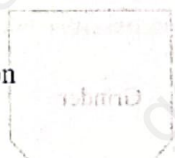
KA1: Auxiliary relay

KM1, KM2: Power contactors for motor.

F- Work required

(a) Establish the power circuit of the motor. (10 marks)

(b) Draw the control circuit of the installation (10 marks)



B- Functioning

Powder comes from the grinder into the hopper driven by a three phase induction motor. A rotation on the push button S₂ provides the following operations:

- If tanks A and B are empty, the motor runs in the forward direction.
- If tank A is empty, the motor runs in the forward direction.
- If tank A is full, the motor runs in the reverse direction automatically.
- If tanks A and B are full, the motor stops.

An action on the push button S₁ or on the emergency button S₀ causes the stop in case of any undesired situation.

C- Signalling and Protection

Motor is direct on line started and it is protected against over load and short circuit.

SECTION B

- The functioning of motor in forward
- The functioning of motor in reverse
- The stop of the level tank by acting the motor
- The stop of supply voltage

B- AC source

Three phase supply, 380V, 50 Hz
 Control voltage supplied by 24V