higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T500(E)(M20)T
APRIL 2012

NATIONAL CERTIFICATE: MULTI-DISCIPLINARY DRAWING OFFICE PRACTICE

ELECTRICAL DRAUGHTING

(8080625)

20 March (X-Paper)
09:00 – 13:00

Candidates will require drawing paper, a calculator and drawing instruments.

Computer-aided software and equipment may be used.

This question paper consists of 4 pages and 3 diagrams sheets.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE: MULTI-DISCIPLINARY DRAWING
OFFICE PRACTICE
ELECTRICAL DRAUGHTING
TIME: 4 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1.   Answer ALL the questions (theory and drawings) on the drawing paper.
       (No EXAMINATION BOOK is required.)

2.   Both sides of the drawing paper may be used.

3.   Read ALL the questions carefully.

4.   Number the answers correctly according to the numbering system used in this
       question paper.

5.   Marks will be allocated for:
       • Line work and neatness
       • Lettering
       • Balanced layout and size
       • Correctness

6.   Write neatly and legibly.

QUESTION 1: GENERAL THEORY

Write the correct alternative and/or missing word(s) in each of the following statements next to the question number (1.1 – 1.10) in the ANSWER BOOK.

1.1 The prefix 'micro' means (x 10^{-3}/x 10^{-6}/x 10^{-9}/x 10^{-12}) and the suffix 'mega' means (x 10^3/x 10^6/x 10^9/x 10^{12}).

1.2 A leading power factor implies that the total (voltage/current/inductance/capacitance) in a circuit is leading the total (voltage/current/capacitance/inductance) in the circuit.

1.3 A ... temperature coefficient implies that the (resistance/current/volume/voltage) of a substance will increase if the temperature of the substance is increased significantly.

1.4 A diode is forward biased when the (emitter/gate/cathode/anode) is positive with respect to the (collector/gate/cathode/anode).

1.5 According to (Faraday's/Ohm's/Lenz's/Kirchhoff's/Joule's) law, the current in a circuit is directly proportional to the applied ... and indirectly proportional to the resistance of the circuit.

1.6 ... currents are induced in the metal parts of AC-machines which cause unwanted ... in the form of heat.

1.7 A(n) (series resistor/shunt resistor/instrument transformer/capacitor/diode) is normally used to extend the range of a DC ...-meter.

1.8 An AC ammeter measures the (effective/average/minimum/instantaneous/maximum) value of the electrical ... .

1.9 A DC (universal/series/shunt/compound/induction) motor has a very high starting ... and runs at a relatively high speed under no-load conditions.

1.10 A stroboscopic effect is caused by the pulsating luminous output of a(n) (infra-red/incandescent/fluorescent/ultraviolet/discharge) lamp operating from a(n) ... supply. (10 × 2) **[20]**

QUESTION 2: GRAPHICAL SYMBOLS AND ELECTRONIC DIAGRAMS

FIGURE 1 on the attached DIAGRAM SHEET 1 represents a freehand drawing of an electronic circuit designed by an engineer. Use the information on the free hand drawing to draw a neat, labelled circuit diagram so that the completed drawing will be ready for reproduction. Improve the layout where possible. **[20]**

QUESTION 3: GENERATION AND DISTRIBUTION OF ELECTRICITY

FIGURE 2.1 on the attached DIAGRAM SHEET 2 shows THREE single phase transformers. Draw these transformers on the drawing paper and show, by means of your drawing, how to connect the terminal points in order to let these three transformers function as a three-phase DELTA-DELTA-transformer.

The transformer has an apparent power (kVA-rating) of 100 kVA, the primary line voltage is 11 kV and the secondary line voltage is 3,3 kV. Show ALL the line and phase values (voltages and full load currents) as well as the primary and secondary external line connections (L1, L2 and L3 or else R, Y, B) on the drawing.

FIGURE 2.2 on the attached DIAGRAM SHEET 2 shows the graphical multi-line symbol for a DELTA-DELTA three-phase transformer and may be of some assistance.

NOTE: Apparent power (kVA rating): $S = \sqrt{3} \times V_L \times I_L$ or $S = 3 \times V_p \times I_p$
Delta: $V_L = V_p$ and $I_L = \sqrt{3} \times I_p$

[20]

QUESTION 4: ELECTRICAL MOTORS AND CONTROL DEVICES

FIGURE 3 on the attached DIAGRAM SHEET 3 is a freehand drawing of a direct-on-line, FORWARD-REVERSE, three-phase motor starter.

You are requested to neatly redraw the multi-line wiring diagram of the complete circuit. Improve the circuit layout where possible, draw the main (power) circuit and the control circuit separately (as given) and improve/complete the item designation in accordance with IEC publication 750.

[20]

QUESTION 5: WIRING OF PREMISES

Draw a standard building plan elevation for a workshop and make provision for a:
- Transformer room
- Store room
- Changing room
- Reception office
- General office
- Workshop area that will cover at least 60% of the total area

In the workshop area provision must be made for at least:
- 18 double-tube fluorescent lights
- 4 single-phase socket outlets
- 4 three-phase socket outlets
- 2 ceiling fans
- Any other electrical points you consider essential

A legend of symbols must accompany the drawing and all applicable SABS regulations must be taken into account.
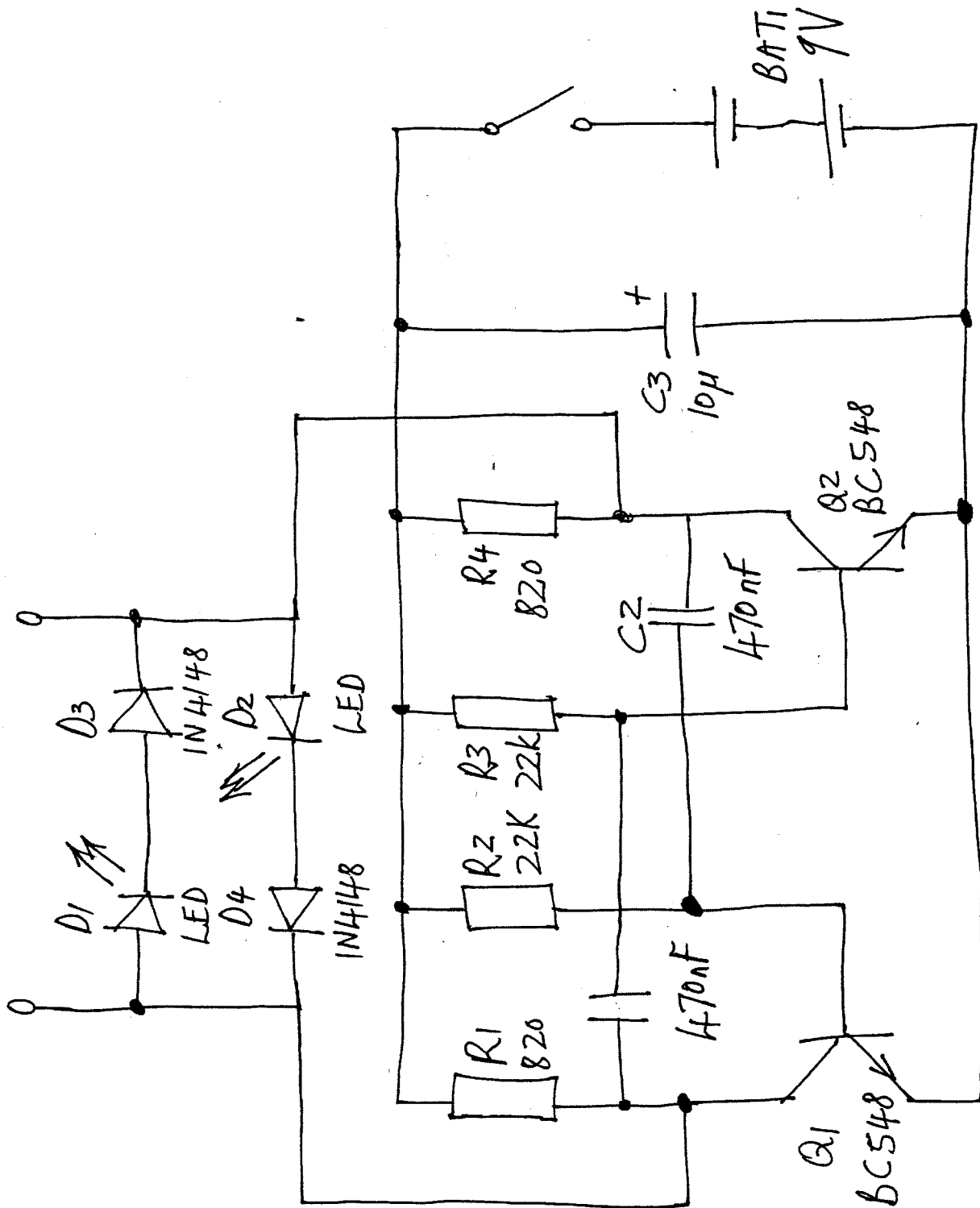
[20]

TOTAL: 100

DIAGRAM SHEET 1

FIGURE 1

DIAGRAM SHEET 2
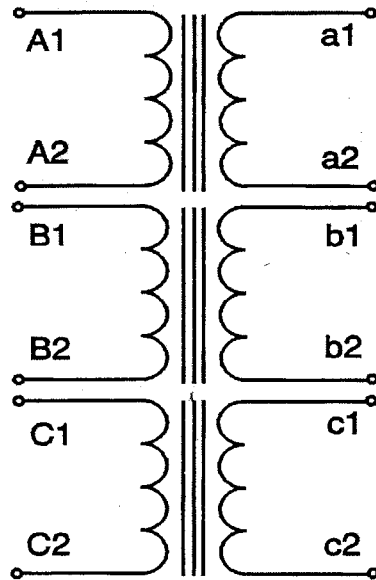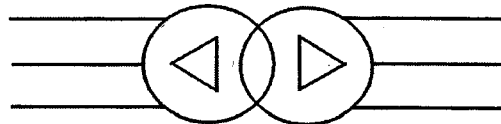
SINGLE-PHASE TRANSFORMERS
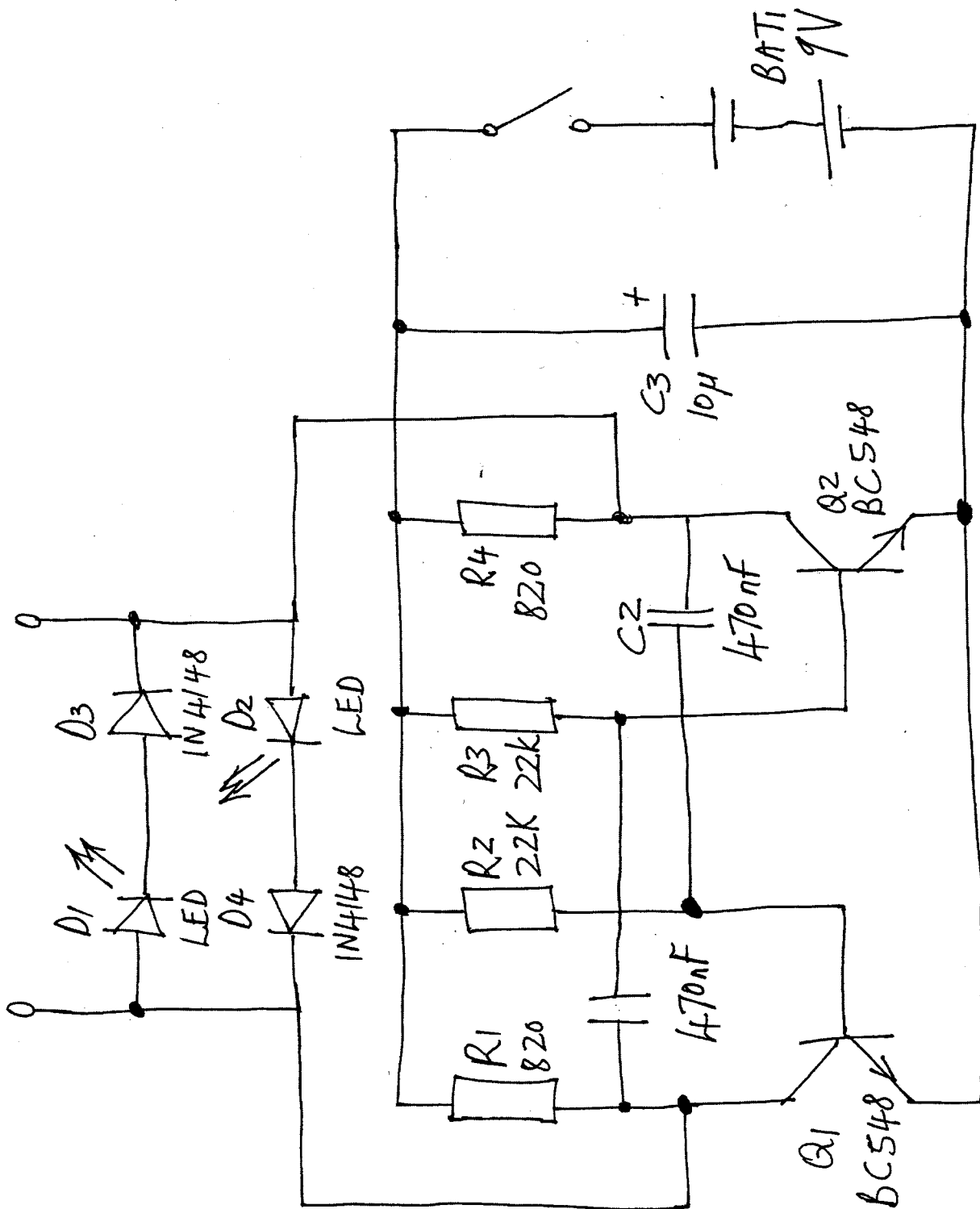

FIGURE 2.1

DELTA

FIGURE 2.2

DIAGRAM SHEET 1

FIGURE 1

DIAGRAM SHEET 3

FIGURE 3