higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T500**(E)**(N19)T
NOVEMBER 2012

NATIONAL CERTIFICATE

MULTI-DISCIPLINARY DRAWING OFFICE PRACTICE: ELECTRICAL DRAUGHTING

(8080625)

19 November (X-Paper)
09:00 – 13:00

REQUIREMENTS: Drawing paper, a calculator and drawing instruments

Computer-aided software and equipment may be used.

This question paper consists of 5 pages and 3 diagram sheets.

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MULTI-DISCIPLINARY DRAWING OFFICE PRACTICE:
ELECTRICAL DRAUGHTING
TIME: 4 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Read ALL the questions carefully.

2. Answer ALL the questions (theory and drawings) on drawing paper (no ANSWER BOOK is required).

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

4. Marks will be allocated for:

   4.1 Line work and neatness
   4.2 Lettering
   4.3 Balanced layout and size
   4.4 Correctness

5. Write neatly and legibly.

QUESTION 1: GENERAL THEORY

1.1 What conductor size (mm²) would you recommend for each of the following circuits or subcircuits for the wiring of premises?

1.1.1 Main supply for the distribution board

1.1.2 Cooking appliances

1.1.3 Geysers

1.1.4 Socket outlets (power points)

1.1.5 Illumination (5)

1.2 Given the next formula and applicable information, you are required to calculate the total required illumination flux for a new room according to the SABS Code of Practice for Interior Lighting:

$$\text{Total required flux } (\Phi) = \frac{E_{av} \times A}{M \times CU \times LLD}$$

- Recommended illuminance per square meter 600 lumen/m²
- Coefficient of utilisation 0,7
- Lamp lumen depreciation 0,8
- Maintenance factor 0,9
- Floor area 80 m² (4)

1.3 THREE 230 V incandescent lamps of 100 W each are connected in parallel to an AC single-phase 230 V supply.

Calculate the following and write the correct answer next to the question number (1.3.1 – 1.3.5) in the ANSWER BOOK. No calculations need to be shown.

Use the appropriate unit symbol in each case (for example volts = V) (1)

1.3.1 Total electrical power consumption (watts)
1.3.2 Electrical current through each lamp (amperes)
1.3.3 Total electrical current flow (amperes)
1.3.4 Resistance per lamp (ohms)
1.3.5 Total resistance of the lamps (ohms) (5 x 2) (10)
[20]

QUESTION 2: GRAPHICAL SYMBOLS AND ELECTRONIC DIAGRAMS

FIGURE 1, DIAGRAM SHEET 1 (attached) represents a 12 V to 14 V voltage regulator for an alternator in a motor vehicle.

The technician who designed and drew the given electrical diagram was not sure about the correct symbols for the windings (coils) and the diodes of the alternator and therefore took the initiative to draw it.

Use the given diagram to draw a neat, labelled drawing with correct graphical symbols that will be ready for reproduction. Improve the layout where possible. **[25]**

QUESTION 3: GENERATION AND DISTRIBUTION OF ELECTRICITY

Make a neat, fully labelled, freehand drawing of a typical three-phase distribution transformer that clearly shows the construction and layout as seen from the outside.

The drawing must include the enclosure with a pipe-cooling system, an oil tank with a breather as well as minimum line connection terminals. **[15]**

QUESTION 4: ELECTRICAL MOTORS AND CONTROL DEVICES

FIGURE 2, DIAGRAM 2 (attached) represents the layout of the six terminals (A1, A2, B1, B2, C1, C2) inside the terminal box of a three-phase motor. Terminal A1 and A2 are connected to winding A of the motor, terminal B1 and B2 are connected to winding B of the motor and terminal C1 and C2 are connected to winding C of the motor.

Use the given layout in FIGURE 2 and draw a neat, labelled drawing of the terminal box with the SIX terminals and show how to connect a cable from a three-phase power supply directly to these terminals in order to let the motor operate in STAR-mode when switched on. Number the supply lines L1, L2 and L3. **[15]**

QUESTION 5: WIRING OF PREMISES

FIGURE 3, DIAGRAM SHEET 3 (attached) is a single-line circuit diagram that represents the layout of a three-phase, four-wire, 400 V/230 V, 50 Hz distribution board (DB) with circuit breakers, isolator switches and electrical devices (loads) connected to it.

Given the diagram, draw a new schematic multiline circuit diagram that represents exactly the same three-phase DB to which ALL the same given devices and equipment are connected.

Take note that a single-line circuit diagram differs from a multiline circuit diagram in that it is a simplified multiline diagram. Instead of multiline connections it consists only of single-line connections with special graphical symbols for single-line diagrams.

The drawing must include essential safety devices such as circuit-breakers and isolating switches. No circuit-breaker ratings or other calculations need to be shown. You may assume that ALL devices (loads) are already well balanced. **[25]**

TOTAL: 100

DIAGRAM SHEET 1

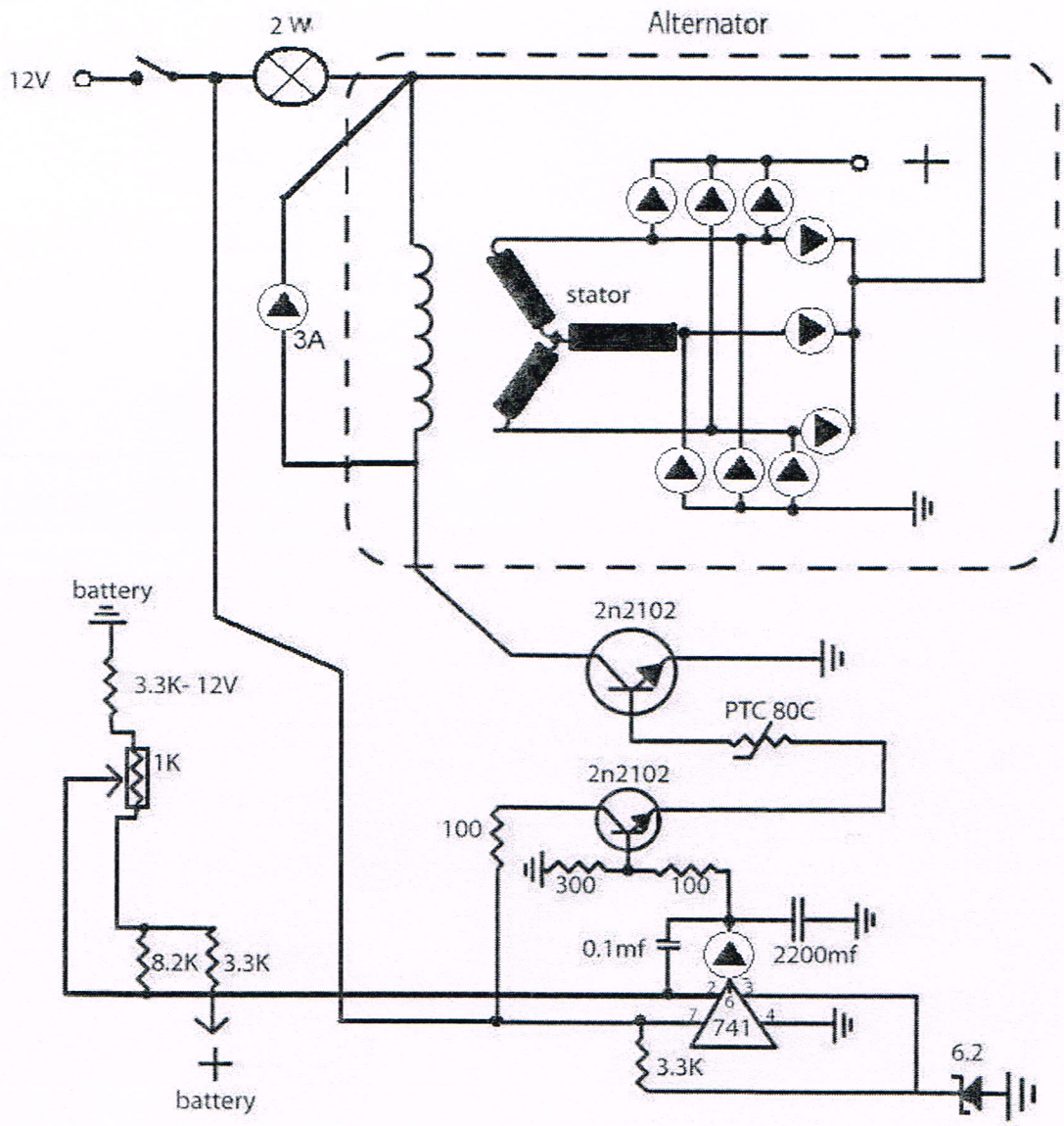

FIGURE 1: VOLTAGE REGULATOR

DIAGRAM SHEET 2

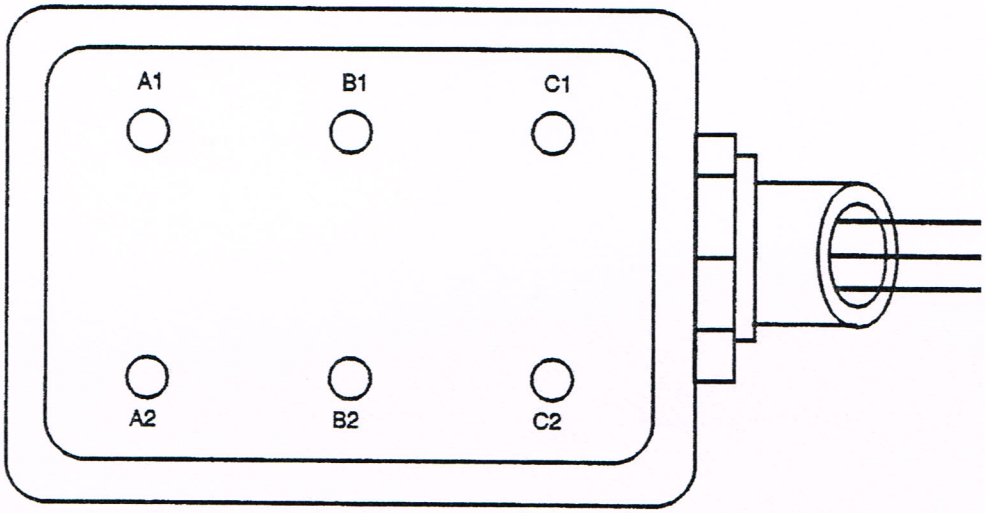

FIGURE 2: TERMINAL BOX

DIAGRAM SHEET 3

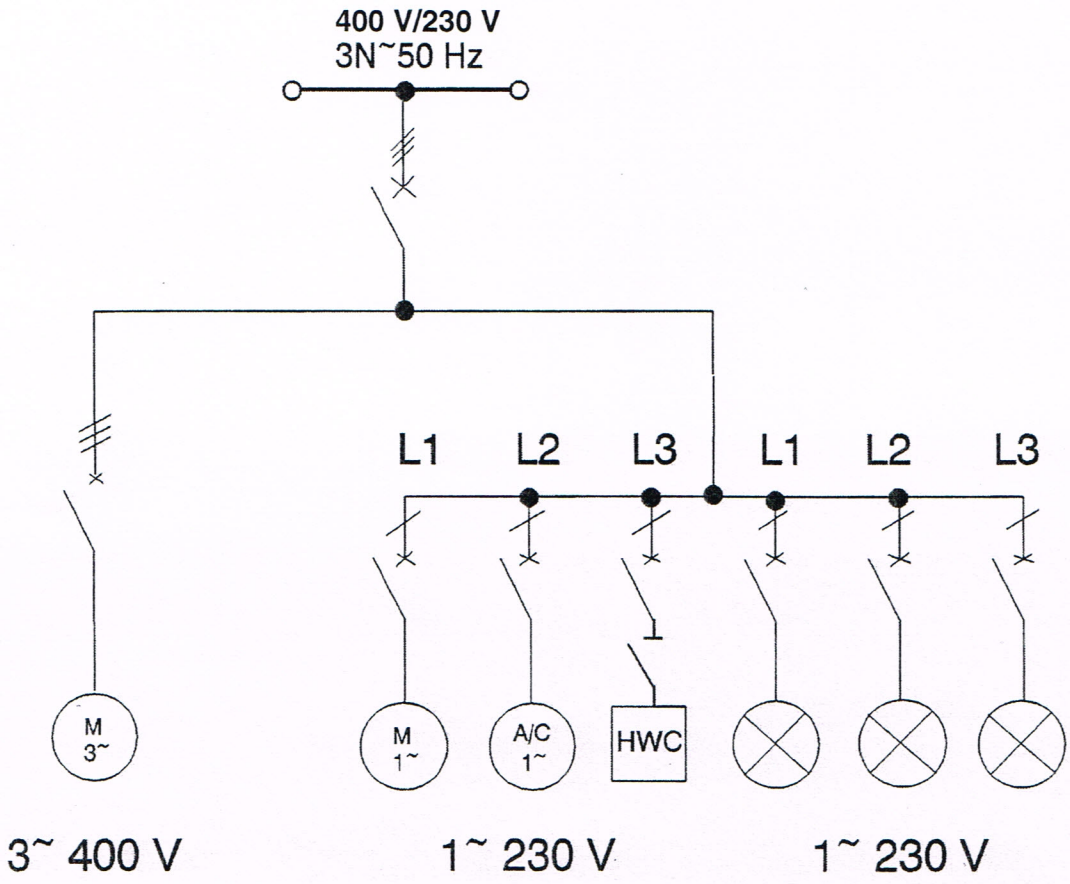

FIGURE 3: THREE-PHASE DISTRIBUTION BOARD (SINGLE-LINE DIAGRAM)