higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NON-NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY

PLANT ENGINEERING: FACTORIES

(8190316)

9 November 2022 (X-paper)
09:00–12:00

CLOSED-BOOK EXAMINATION

REQUIREMENTS: Steam tables

Alpha-numerical or programmable calculators may NOT be used.
Non-programmable calculators may be used.

328Q1E2209

This question paper consists of 6 pages and 1 information sheet.

328Q1E2209

SECTION A (COMPULSORY)

QUESTION 1

1.1 Name the function of each of the following items, including the heat source and state where each is installed on a 10-ton coal-fired steam generator plant:

1.1.1 Economiser

1.1.2 Evaporator

1.1.3 Superheater

1.1.4 Air preheater (4 × 2)

1.2 Give the functions of the water-level control fitted to a coal-fired steam generator.

1.3 Name TEN items to be checked or to be done every EIGHT hours on a coal-fired steam generator. (1

[2

QUESTION 2

2.1 A 25 kVA single-phase motor has a power factor of 0,8 lagging. A 10 kVA R-capacitor is connected for power factor correction.

Calculate the input taken from the mains in kVA and its power factor and sketch a phasor diagram for each case when the motor is

2.1.1 on half load (6

2.1.2 on full load (5

2.2 Name THREE major components of a PV installation and discuss the function of each component. (6

2.3 You have installed an alternative supply at your plant that you want to connect to the supplier's grid. What do you need to do and determine before you may connect it to the grid? (3)

[20]

QUESTION 3

3.1 Inputs to the risk assessment processes can include information or data on the following:

- details of location(s) where work is carried out,
- the proximity and scope for hazardous interaction between activities in the workplace,
- security arrangements.

Name TEN other inputs to this process.

3.2 Incidents in the workplace have two groups of root causes. They are classified as personal, and job related. Name FIVE causes in each group. (2 × 5)

TOTAL SECTION A:

SECTION B

Answer any TWO question in SECTION B.

QUESTION 4

4.1 A steel transmission line, stretched between two points on the same level 20 m apart, has a sag of 750 mm. Determine the increase in the sagging due to a rise in temperature of 25 °C. For steel, the coefficient of linear expansion is $11 \times 10^{-6/°}$C. (10

4.2 Name the factors that one will consider when choosing between aluminium and copper conductors for the transmission of electricity. (7)

4.3 Name the THREE major welding methods for welding aluminium alloys. (3)

[20]

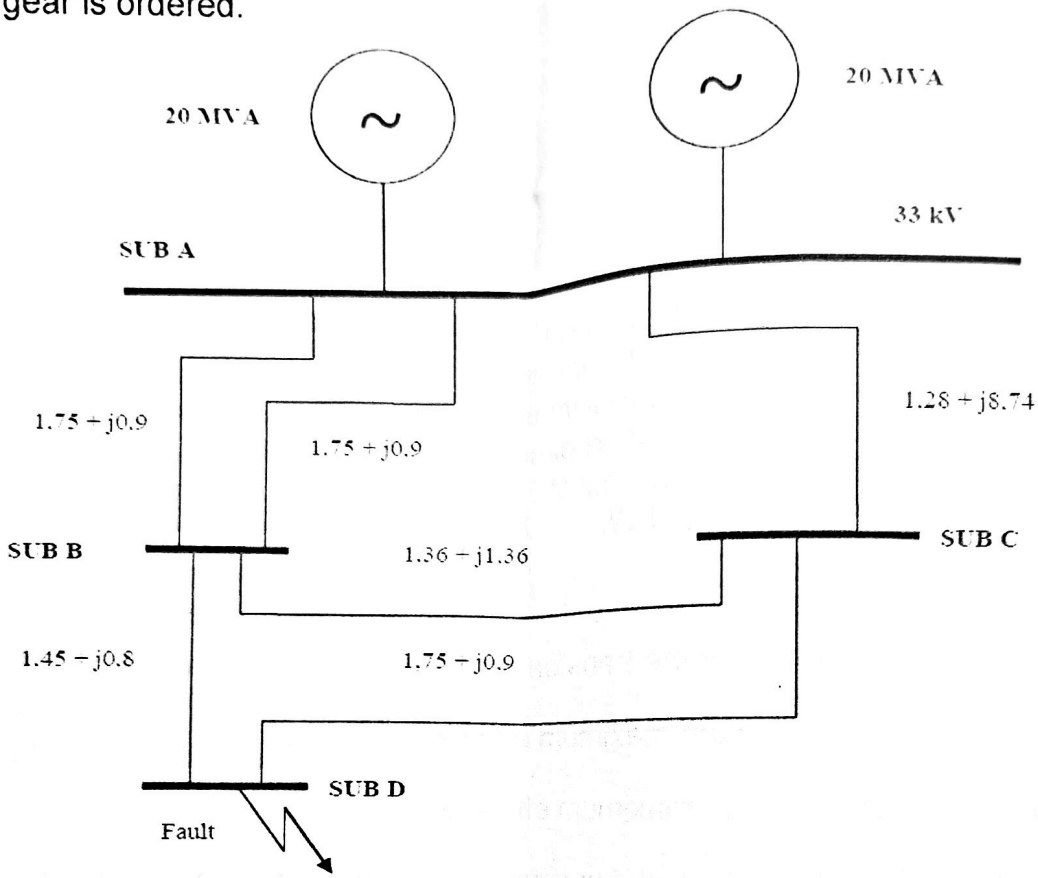
QUESTION 5

5.1 Name FIVE requirements for the installation of a water heater connected to an electrical installation. (5)

5.2 Name FIVE types of water heaters that are regulated and connected to an electrical installation. (5)

5.3 The network needs to be upgraded.

Determine the fault current at F in the network below to ensure that the correct switchgear is ordered.



(10)
[20]

QUESTION 6

6.1 You have the following information on a belt drive:

Diameter of the pulley on the motor:	150 mm
Diameter of the follower:	750 mm
Speed of the motor:	1 500 r/min
Centre distance between the parallel pulleys:	1 meter
Mass of the belt:	0,4 kg/m
Maximum tension:	720 N
Cross sectional area of the belt:	320 mm^2
Friction, μ = 0,4	
E = 300 MN/m^2 (for the material).	

Calculate:

6.1.1 the maximum tension difference allowing for the inertia of the belt

6.1.2 the speed of the driven pulley at the maximum condition

6.1.3 the power transmitted to the driven pulley

(3 × 4) (12)

6.2 A compressor room with compressed air reticulation should be installed at the plant.

6.2.1 Name THREE critical considerations when designing the compressor room for it to work correctly.

6.2.2 Name FIVE good practices when designing the reticulation piping system. [2

QUESTION 7

7.1 A single-phase transformer is rated at 10 kVA, 230 V/100 V. When the secondary terminals are open-circuited and the primary winding is supplied at normal voltage (230 V), the current input is 2,6 A at a power factor of 0,3. When the secondary terminals are short-circuited, a voltage of 18 V applied to the primary causes the full-load current (100 A) to flow in the secondary, the power input to the primary being 240 W.

Calculate:

7.1.1 the efficiency of the transformer at full load, unity power factor (8)

7.1.2 the load at which maximum efficiency occurs (4)

7.1.3 the value of the maximum efficiency (4)

7.2 Consumers A and B are fed from the same line. The non-linear loads of consumer A will distort the voltage of consumer B even if the latter only has linear loads. Give FOUR examples of negative effects of harmonics. (4)

[20]

QUESTION 8

8.1 There is an increase in three-phase standby-generator installations to provide electricity in case of a mains power failure. Draw a wiring diagram for a low voltage generating set with the local supply network using

8.1.1 an automatic change-over switch (6)

8.1.2 a manual change-over switch (4)

8.2 You want to use a 200-ton mobile crane with outriggers to install a new paper mill inside the factory. What factors must be considered regarding the condition of the ground? (6)

8.3 An eroded valve in a 200 mm slurry pipeline needs to be replaced. Name FOUR types of valves that one will consider for this application. (4)

[20]

TOTAL SECTION B: 40