Electrical Power Protection and Plant Commissioning Engineer

Practice Knowledge Assessment: sample questions

Knowledge Assessment Details

The assessment consists of 20 short answer questions with 5 questions for each of the 4 topic areas shown below. Each of these topic areas will contain 1 **safety critical question.**

The 4 topic areas are as follows:

1. A comprehensive understanding of **electrical power systems**
2. Understands **protection, control and telemetry equipment** and the impact on the **electrical network of its operation**
3. Understands **high voltage electrical network operations and topologies**
4. Understands the application of **Electricity Supply Standards, regulations and policies**

The assessment has a maximum duration of 150 minutes. Consequently, each topic area should take approximately 30 – 35 minutes to complete with each short answer question taking approximately 6 minutes to answer. You are advised to start with the safety critical questions and spend more time on them if required. Not scoring full marks on these questions will lead to a fail.

Each question is marked out of 3 marks.

To attain a Pass, the apprentice must:

- Score at least 65% (39 marks)
- Must achieve all the marks in the four safety-critical questions

To attain a Distinction, the apprentice must meet the Pass criteria AND:

- Score at least 90% (54 marks)

The mark scheme has been broken down into the level of response for each question and includes a descriptor.

EPPPCE Practice Assessment Questions

1.0 A comprehensive understanding of electrical power systems

Practice Question:

Draw a diagram to support your answer and describe the design principles of **BOTH** ring and radial power circuits and identify their advantages and disadvantages.

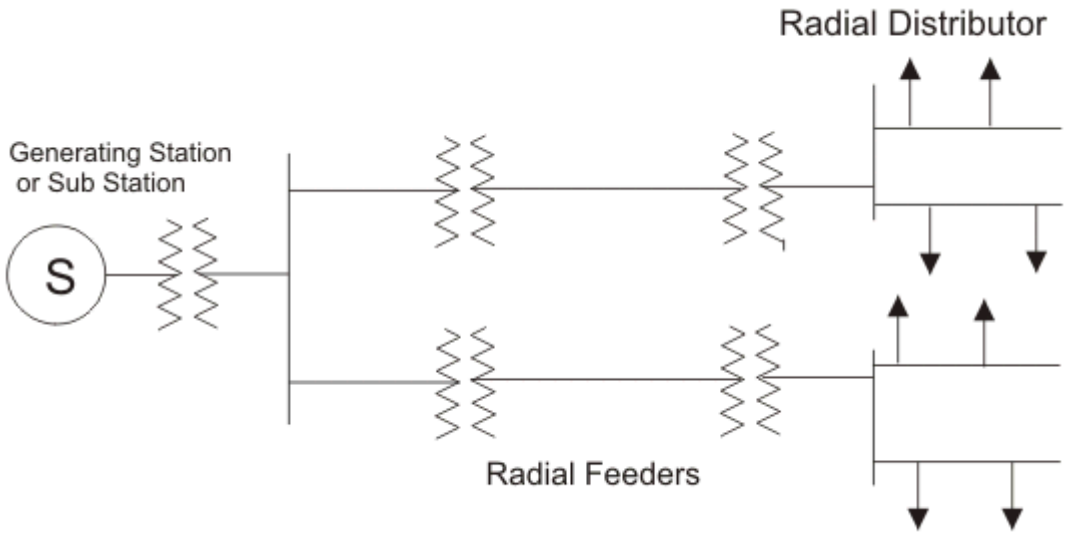
Mark Scheme:

The apprentice will typically demonstrate:	Marks
A diagram demonstrating the design principles of **BOTH** ring and radial circuits A technical description of **BOTH** types of circuits A minimum of **ONE** advantage and **ONE** disadvantage for **BOTH** types of circuit	3
A diagram demonstrating the design principles of **BOTH** ring and radial circuits A technical description of **BOTH** types of circuits A minimum of **ONE** advantage for **BOTH** types of circuit and **ONE** disadvantage for **ONE** type of circuit	2
A diagram demonstrating the design principles of **BOTH** ring and radial circuits A technical description of **BOTH** types of circuits A minimum of **ONE** advantage and **ONE** disadvantage across **EITHER** type of circuit	1

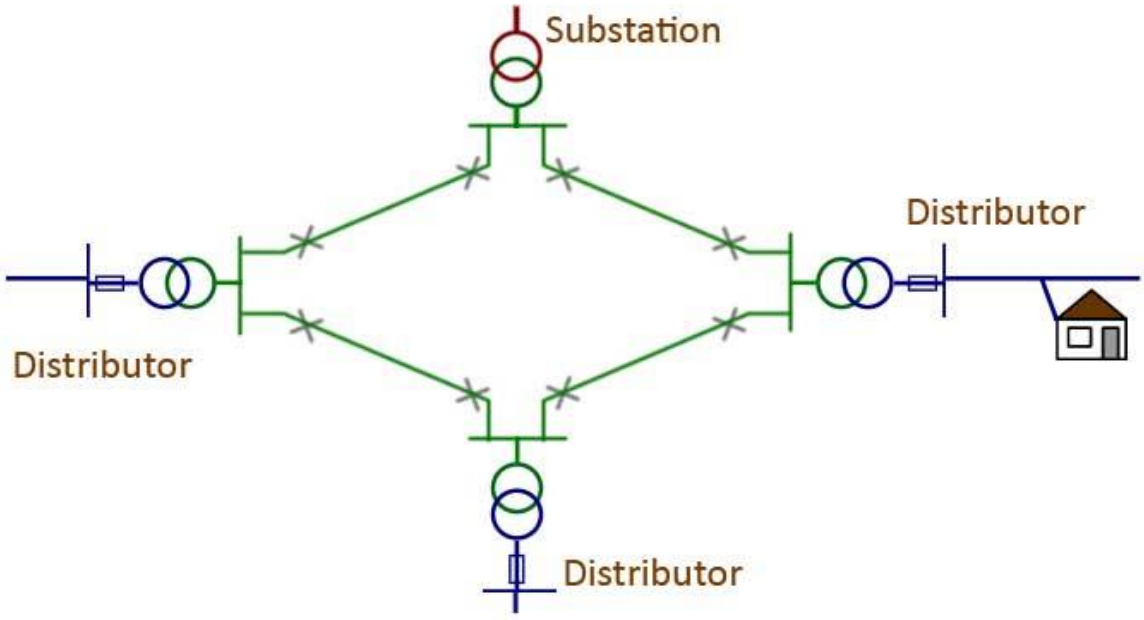
Sample Response:

A technical diagram demonstrating the design features of both ring and radial circuits

Typical accepted responses: Example 1. Radial Circuit



Typical accepted responses: Example 2. Ring Circuit



A technical description of BOTH types of circuits

Accepted responses design principles of ring circuits:

- Designed to make a ring of the main circuit with more than one potential feed
- Provides ability to feed from either direction in the circuit
- Provides ability to make open / interconnection points in the circuit

Accepted responses design principles of radial circuits

- Designed to make a single feed linear circuit
- Provides ability to feed from either direction in the circuit
- Provides ability to make open / interconnection points in the circuit

The advantages and disadvantages of ring and radial circuits

Accepted responses for advantages of ring circuits:

- Greater security of supply by providing the facility to interconnect at different points in the circuit
- Greater flexibility to support the restoration of supplies for more customers
- Improved customer / regulatory satisfaction due to reduced outages and loss of supplies

Accepted responses for disadvantages of ring circuits:

- Increased cost of construction and maintenance of more infrastructure
- Complex process of fault finding by isolation of sections of the circuit

Accepted responses for advantages of radial circuits:

- Reduced costs of construction and maintenance as only a single supply
- Simpler fault-finding process because only a single one direction supply
- Cost effective option for supplies to remote locations

Accepted responses disadvantages responses for radial circuits:

- Limited network flexibility for the restoration / isolation of customer supplies as no option to backfeed
- Potentially takes longer to restore supplies and more customers adversely affected as whole feed has to be isolated.

These advantages and disadvantages are not exhaustive, and all submitted responses should be considered on their merit.

EPPPCE Practice Assessment

2.0 Understands protection, control and telemetry equipment and the impact on the electrical network of its operation

Practice Question

Describe the typical types of voltage transformer (VT) which can be found in a power substation and describe their usage. Draw a diagram and explain the typical process which occurs when a voltage transformer (VT) is activated by a fault on the network.

The apprentice will typically demonstrate:	Marks
A description of a minimum of **THREE** typical types of voltage transformers (VT) found in power substations supported by a description of their usage A technical explanation of the process which occurs when a voltage transformer (VT) is activated by a fault A technical diagram which supports the principles of the operating process	3
A description of a minimum of **TWO** typical types of voltage transformers (VT) found in power substations supported by a description of their usage An explanation of the process which occurs when a voltage transformer (VT) is activated by a fault A technical diagram which supports the principles of the operating process	2
A description of a minimum of **ONE** typical type of voltage transformer (VT) found in power substations supported by a description of their usage An explanation of the process which occurs when a voltage transformer (VT) is activated by a fault A technical diagram which supports the principles of the operating process	1

A detailed technical description the typical types and usage of voltage transformers (VT) in a power substations

Accepted responses:

- Capacitor VT / Single Phase VT / Inductive VT
- To reduce the voltage to a manageable level for the equipment being used
- To monitor and control the transformer automatic voltage regulating relay (AVR) which controls the tap changer
- To supply power to volt meters and watt meters

A technical explanation of the process which occurs when a voltage transformer (VT) is activated by a fault

Accepted responses:

A technical explanation which contains the following principles.

- Voltage transformers can be used to measure the residual voltage of a three phase system during single phase faults
- During normal operating conditions, the sum of the three phase voltage is zero but in case of single phase fault, the condition changes and a residual voltage is produced

These answers are not exhaustive, and all submitted responses should be considered on their merit.

EPPPCE Sample Assessment Questions

3.0 Understands high voltage electrical network operations and topologies

Practice Question – Safety Critical

Transmission systems employ Delayed Auto Reclose (DAR) technology and Distribution systems employ Auto Reclose (AR) technology. Describe the purpose of the Auto Reclose system relevant to your network and the advantages it provides. Then with the aid of a diagram explain a typical cycle of operation and the roles of the persons involved in responding to the activation of the auto reclose system

The apprentice will typically demonstrate:	Marks
A technical description of the purpose of DAR or AR and a minimum of **THREE** advantages it provides An explanation supported by a technical diagram of a typical cycle of operation A description of a minimum of **THREE** persons and their roles in responding to the activation of the system	3
A technical description of the purpose of DAR or AR and a minimum of **TWO** advantages it provides An explanation supported by a technical diagram of a typical cycle of operation A description of a minimum of **TWO** persons and their roles in responding to the activation of the system	2 (Fail)
A technical description of the purpose of DAR or AR and a minimum of **ONE** advantage it provides An explanation supported by a technical diagram of a typical cycle of operation A description of a minimum of **ONE** person and their role in responding to the activation of the system	1 (Fail)

A technical description of the purpose of DAR or AR and the advantages it provides

Accepted responses:

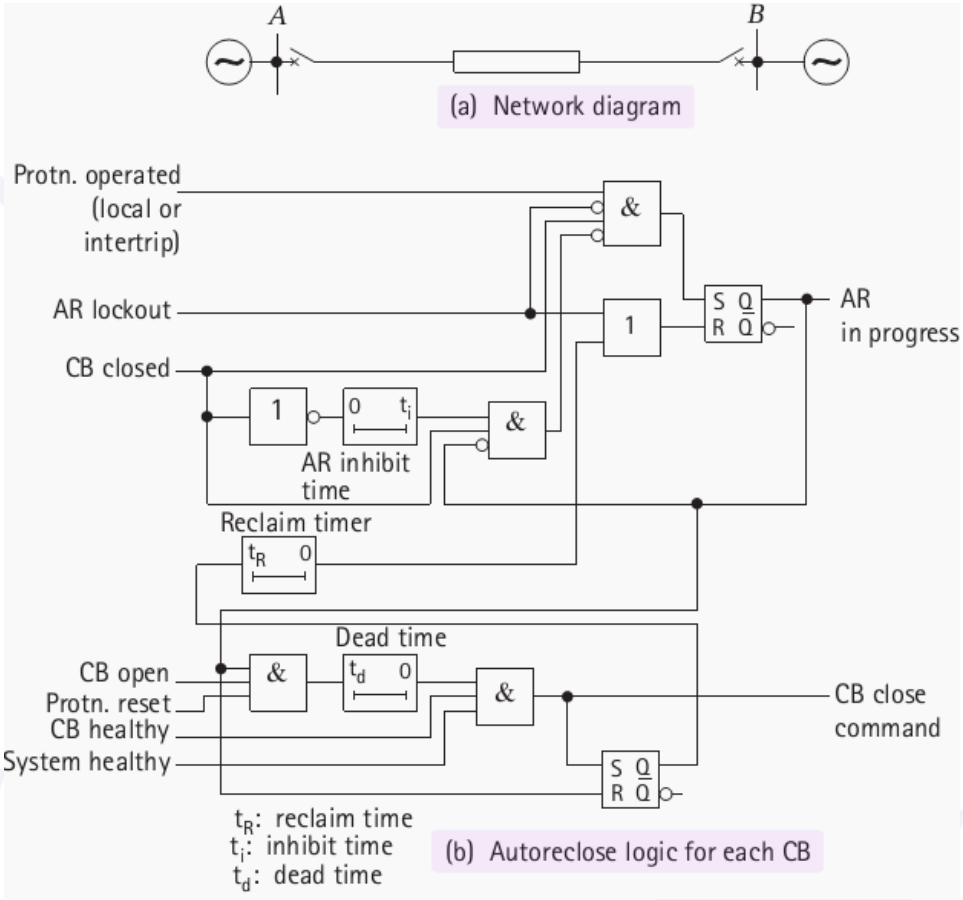
- To provide fast and efficient network protection
- To prevent loss of power
- To detect temporary or permanent faults

- To provide quick and efficient restoration of supplies
- Simplifies control circuits in comparison with single-phase schemes
- Delayed auto-reclosing improves the chances of a reclosure being successful in comparison to the case of high-speed reclosing

An explanation supported by a technical diagram of a typical cycle of operation

Typical accepted responses:

DAR Example diagram



In the example above, if it were decided to charge the line initially from station A, the dead time in the auto-reclose relay at A would be set at, say, 5 seconds, while the corresponding timer in the auto-reclose relay at B would be set at, say, 15 seconds. The circuit breaker at A would then reclose after 5 seconds provided that voltage monitoring relays at A indicated that the busbars were alive and the line dead.

With the line recharged, the circuit breaker at B would then reclose with a synchronism check, after a 2 second delay imposed by the synchronism check relay element.
If for any reason the line fails to 'dead line charge' from end A, reclosure from end B would take place after 15 seconds. The circuit breaker at A would then be given the opportunity to reclose with a synchronism check.

A description of the persons and their roles in responding to the activation of the system

Accepted responses:
A technical explanation which contains the following principles.

- The identification and description of the persons who may be involved in responding to the activation of the DAR or AR system. Which may include the: Control Engineer, Network Engineer, Craft Persons
- Reference may be made to their level of authorisation and their typical duties and responsibilities during the operation (May be specific to the Company)

These answers are not exhaustive, and all submitted responses should be considered on their merit.

EPPPCE Sample Assessment Questions

4.0 Understands the application of Electricity Supply Standards, regulations and policies

Practice Question

The Electricity at Work Regulations 1989 apply to all electrical systems and equipment and require precautions to be taken against the risk of death or personal injury from electricity in work activities.

In relation to the regulations, describe the requirements for **BOTH** of the following items.

a) The general requirements of Regulation 11 in relation to the means of protection from excess current

b) The specified conditions stated in Regulation 14 which must be met before live work could be considered on or near live conductors.

Level	The apprentice will typically demonstrate:	Marks
3	A description identifying a minimum of **FOUR** requirements for the protection of electrical systems A description identifying a minimum of **THREE** of the requirements which must be met before live work could be considered on or near live conductors	3
2	A description identifying a minimum of **THREE** requirements for the protection of electrical systems A description identifying a minimum of **TWO** of the requirements which must be met before live work could be considered on or near live conductors	2
1	A description identifying a minimum of **TWO** requirements for the protection of electrical systems A description identifying a minimum of **TWO** of the requirements which must be met before live work could be considered on or near live conductors	1

Regulation 11 requirements for the means of protection from excess current

Accepted responses:
A technical explanation which contains the following principles.

- The regulations require that systems and parts of systems be protected against the effects of short circuits and overloads if these would result in currents which would otherwise result in danger.
- The regulations state the means of protection is likely to be in the form of fuses or circuit breakers controlled by relays etc, or it may be provided by some other means capable of interrupting the current or reducing it to a safe value.
- That a means of preventing danger to be provided in anticipation of excess current
- That In principle, every main circuit should be protected at its origin, i.e. at the source end of the circuit
- That when considering a means of protection, consideration must be given to a number of factors, including:
  (a) the nature of the circuits and type of equipment to be protected
  (b) the short-circuit energy available in the supply (the fault level)
  (c) the nature of the environment
  (d) whether the system is earthed or not

Regulation 14 requirements which must be met before live work could be considered on or near live conductors

Accepted responses:
A technical explanation which contains the following principles.

(a) it is unreasonable in all the circumstances for it to be dead; and
(b) it is reasonable in all the circumstances for him to be at work on or near it while it is live
(c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

These answers are not exhaustive, and all submitted responses should be considered on their merit.