

This **examination consists** of two sections.

Section A - Twenty short answer questions worth three marks each. Candidates must answer **ALL TWENTY** questions. It is recommended that candidates allow approximately one *hour* for this section.

Section B—Six structured questions worth 15 marks each. Candidates must **answer ALL SIX** questions. It is recommended that **candidates** allow **approximately** 1¹/₂ hours for this section.

Section A - Answer **ALL TWENTY** questions in this section.

- 1 Three single sockets have been added to a ring final circuit. State the.
 - a) inspection and test certificate that will need to be completed (1 mark)
 - b) title in law given to the inspector (1 mark)
 - c) legal status of the inspector (1 mark)

- 2 An engineering works is 18 years old and is due for inspection and test. State the
 - a) type of inspection and test required (1 mark)
 - b) documents that must accompany the completed certificate (1 mark)
 - c) circumstances under which the type of inspection and test in a) above may not be required. (1 mark)

- 3 State the legal status of the following
 - a) BS 7671 2001 (1 mark)
 - b) Guidance Note 3 (1 mark)
 - c) HSE GS38 (1 mark)

- 4 Give **ONE** example of **EACH** of the following
 - a) an exposed conductive part (1 mark)
 - b) an extraneous conductive part (1 mark)
 - c) direct contact (1 mark)

- 5 State **THREE** methods of protection against indirect contact (3 marks)

- 6 State the earthing systems that use the following as return earth paths
 - a) PEN conductor (1 mark)

- b) cable sheath (1 mark)
- c) general mass of earth (1 mark)
- 7 State the test instruments to be used for the following tests
- a) continuity of supplementary bonding in a bathroom (1 mark)
- b) external earth fault loop impedance of a TN-C-S system (1 mark)
- c) live polarity (1 mark)
- 8 Give THREE examples of notices/warning labels that should be present in an electrical installation (3 marks)
- 9 State the IP code that applies to the following enclosures
- a) accessible horizontal top surfaces (1 mark)
- b) internal intermediate barriers (2 marks)
- 10 The continuity of a lighting circuit c.p.c. is verified using the phase conductor as part of the test. State the
- a) instrument to be used (1 mark)
- b) action to be taken regarding the test leads (1 mark)
- c) significance of the reading at the furthest point (1 mark)
- 11 State THREE outcomes of the ring final circuit continuity test. (3 marks)
- 12 State the test voltage and minimum value of insulation resistance for EACH of the following
- a) 12V fan circuit in a bathroom (1 mark)
- b) three-phase commercial installation (1 mark)
- c) 800V discharge lighting circuit (1 mark)
- 13 Give THREE reasons for carrying out a polarity test on an installation, as required by BS7671 2001 (3 marks)
- 14 The resistance of an earth electrode is to be measured. If a mains supply is unavailable, state the
- a) instrument to be used (1 mark)
- b) terms used to describe the TWO other test electrodes. (2 marks)

- 15 State the maximum disconnection times appropriate to the following
- a) a domestic socket outlet circuit (1 mark)
 - b) site hut lighting on a construction site (1 mark)
 - c) 110V reduced low-voltage system. (1 mark)
- 16 State
- a) why it may not be possible to obtain a measured value of loop impedance for a circuit protected by an RCD (1 mark)
 - b) how this value may be determined without the use of a special instrument (2 marks)
- 17 A loop impedance test is to be conducted on a radial socket outlet circuit. State
- a) where in the circuit the test should be made (1 mark)
 - b) TWO conditions that may affect the validity of the measured value as a comparison to the maximum value (2 marks)
- 18 State THREE reasons for the use of a 20mA RCD. (3 marks)
- 19 In the formula $I_{\Delta n} = 50/Z_s$ state
- a) what is represented by '50' (1 mark)
 - b) the maximum residual current rating of the RCD required, when the value of Z_s is 500Ω (2 marks)
- 20 The PFC at the origin of an installation is to be measured. State the
- a) instrument to be used (1 mark)
 - b) measurement units (1 mark)
 - c) importance of the breaking capacity of the protective devices at the origin (1 mark)

Section B – Answer ALL SIX questions**Questions 21 to 26 all refer to the following scenario and Fig. 1 (attached).**

Fig.1 shows the main intake and circuit arrangements for the new electrical installation in a refurbished dentist's surgery. The heating, ventilating and air-conditioning unit (HVAC), located outside the building is supplied using p.c.v./p.c.v./s.w.a. multicore cable. All other circuits are wired using p.v.c. single-core cables enclosed in concealed p.v.c. conduit and surface trunking (c.p.c's are the same size as the phase conductors). The lighting is a mixture of tungsten filament, fluorescent and PIR-controlled exterior security lights. The installation has been completed and is ready for inspection and testing.

- 21 State the
- a) type of inspection and test to be completed (1 mark)
 - b) certificate that will need to be completed (2 marks)
 - c) signatures that are required on the certificate in b) (3 marks)
 - d) status of the signatories (2 marks)
 - e) documents that must accompany the certificate in b) (2 marks)
 - f) information regarding the incoming supply that should be recorded on ONE of the documents in e) (3 marks)
 - g) person who should keep the original completed documents (2 marks)
- 22 State
- a) the terms used to describe EACH of the following items labelled
 - i) 1
 - ii) 2
 - iii) 3
 - iv) 4(4 marks)
 - b) the earthing system (1 mark)
 - c) where, on the gas and water supplies, item 2 should be connected (2 marks)
 - d) the label that should appear at the connection in c) (1 mark)
 - e) why a type D circuit breaker is used on B9 (3 marks)
 - f) FOUR relevant items to be considered from the BS7671 2001 installation schedule (4 marks)
- 23 List, in the correct sequence, the relevant tests to be carried out on the installation circuits, indicating the instruments to be used for EACH test. (15 marks)

- 24 Describe how
- a) an insulation resistance test would be carried out on circuit R1 (8 marks)
 - b) a c.p.c. continuity test would be carried out on circuit Y5 (7 marks)
- 25 a) The insulation resistance values for circuits R2, B6 and B9 were 3.8MΩ, 4.9Ω and 5.0MΩ respectively. All other circuits were in excess of 999MΩ. Calculate the approximate value of the overall insulation at the origin (7 marks)
- b) When the system is energised and before the sequence of live tests is conducted, it is important to carry out a live polarity test. State
 - i) the reason for this test
 - ii) where this test should be conducted
 - iii) the instrument to be used
 - iv) why the test will not reveal neutral-earth reversals (8 marks)

26 The measured values of earth loop impedance for each circuit are as follows:

CIRCUIT	1	2	3	4	5	6	7	8	9	10
MEASURED VALUES	3.8Ω	2 Ω	2.6 Ω	1.3 Ω	1 Ω	2.5 Ω	2 Ω	1.8 Ω	0.4 Ω	1.2 Ω

- a) State the environment and circuit conditions which may have an effect on these measured values (4 marks)
- b) State how these conditions are compensated for. (1 mark)
- c) Show, by calculation, if the measured values are acceptable (5 marks)
- d) State a solution for any circuit that fails to comply. (5 marks)

Fig 1

