Question 1

You are required to produce a radio communication system that provides coverage for trains within tunnels and for station staff throughout an underground system. The train traction system is an overhead 25kV catenary system.

a) With the aid of diagrams describe your chosen system and explain the factors you would consider as part of your design. [12 marks]

b) Produce an outline test plan including the tests you would undertake to prove the functionality of the system. [13 marks]

Question 2

You are required to design a lineside traction power control system using the IEC 61850 protocol.

With the aid of diagrams, describe your design and the factors including safety that you will consider in the design. Your design should consider all components from the HMI in the control centre to the equipment in sub-stations. [25 marks]
Question 3

You are required to design a Public Address system for a major Interchange station. Part of the station includes an arched station canopy covering several platforms that is known to cause reverberation issues. Additionally, part of the station includes open platforms adjacent to a residential area. The station also has underground platforms which the PA system is required to cover and form part of the emergency evacuation system.

Explain with the aid of diagrams your proposed design and the factors you would consider to achieve the best possible STI. Additionally, describe how the system can be modelled before construction to achieve the required STI level and how the system will be tested to prove performance. [25 marks]

Question 4

You are responsible for the production of test documentation for a project delivering new and amended telecommunications equipment as part of a railway infrastructure renewal project.

a) With the aid of a flow chart, describe the hierarchy of test documentation that you would produce to demonstrate test assurance and support successful testing. [5 marks]

b) Describe the contents you would include within a:
   i. Test Strategy;
   ii. Test Plan. [15 marks]

c) Describe the key risks associated with the telecommunications testing works and how you would mitigate these risks. [5 marks]

Question 5

A train service is to be provided with driver only operated (DOO) CCTV (sometimes known as one-person operation (OPO) CCTV) to allow the train driver to verify that the rolling stock doors are clear of obstructions and can be safely closed.

a) With the aid of a diagram, describe two potential solutions to capture and convey the CCTV images to the driver. [10 marks]

b) Describe the survey process you would adopt to support the development of a robust design solution. [10 marks]

c) Describe how you would test the system to verify it meets functional requirements. [5 marks]
Question 6
You are the telecommunications designer for a project which is to renew a telephone concentrator and associated lineside telephones.

Using a risk assessment methodology of your choice outline the hazards, and proposed mitigations, throughout the asset lifecycle. [25 marks]

Question 7
You are the project engineer working on the specification, design, installation, test and commissioning of a new fixed telecommunications network for a new railway.

a) With the aid of a diagram, outline your chosen architecture and identify services to be managed over the network. Your answer should include specific reference to the technologies, protocols and interfaces you have chosen along with any design constraints. [13 marks]

b) Explain how your chosen system design maximises network availability. [7 marks]

c) Explain how a Network Management System can be used to support the operation and maintenance of your proposed network. [5 marks]

Question 8
You are responsible for the survey, design and testing of a security CCTV system at a major surface or a sub-surface railway station.

a) Outline the factors to be considered during your survey and why they are relevant. [10 marks]

b) Provide a schematic of the solution you would deploy describing the technology you would choose and why. [10 marks]

c) What tests would you recommend to the testing organisation in order to demonstrate system functionality? [5 marks]

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