

**INSTITUTION OF RAILWAY SIGNAL ENGINEERS  
2008 EXAMINATION**

**MODULE 7 - SYSTEM MANAGEMENT AND ENGINEERING**

**TIME ALLOWED - 1 1/2 HOURS**

**10 MINUTES WILL BE ALLOWED AT THE START TO READ THE PAPER.**

ANSWER **THREE** QUESTIONS, ALL QUESTIONS CARRY EQUAL MARKS

WRITE ON ONE SIDE OF THE PAPER ONLY, AND NUMBER EACH SHEET THAT  
YOU USE CONSECUTIVELY

COMMENCE YOUR ANSWER TO EACH QUESTION ON A NEW SHEET OF PAPER

ANSWER SHEETS WILL BE PHOTOCOPIED – PLEASE USE ONLY BLACK INK

**Question 1**

Explain how reliability, maintainability and availability are related to one another. [6 marks]

Identify, and explain the relevance of, three factors that might affect the maintainability of a signalling system. [6 marks]

Use two railway signalling examples to explain how reliability, maintainability and availability can influence safety. [8 marks]

**Question 2**

What features should be included in the product selection, application design, installation and location of each of the following types of signalling equipment in order to ensure the safety of maintenance staff.

- Colour light signals
- Point machines
- Track circuits
- Lineside power distribution

You should take into account the possible effects of electric traction.

[20 marks]

Paper continued on next page

### Question 3

A railway is equipped with multiple aspect lineside signalling and a comprehensive ATP system. As the signalling member of an inquiry team investigating the causes of a derailment at a junction on this railway, what evidence would you look for to establish whether the signalling system had contributed to the accident in any way? [20 marks]

### Question 4

What are the main chapters of a safety case as defined by EN 50129? Explain how each of these chapters contributes to making the overall case for safety. [15 marks]

How would the Generic Application Safety Case and the Application Specific Safety Case for a signal interlocking differ in scope? [5 marks]

### Question 5

Describe the key features of an automatic route setting system with which you are familiar. [3 marks]

Outline the advantages and potential disadvantages of implementing this automatic route setting system. [8 marks]

Describe one scenario where it would be desirable to suspend the use of automatic route setting for operational reasons. Within your description outline the technical and operational arguments that should be considered in assessing whether or not to do so. [6 marks]

Describe one scenario where it would be desirable to suspend the use of automatic route setting for safety reasons. [3 marks]

### Question 6

There is a project to build a new railway. The Signalling and Telecommunications systems are to be designed and supplied by multiple organisations, with further suppliers responsible for enabling works (such as power supplies and equipment rooms) and for rolling stock provision.

What activities are required during the design, installation and commissioning phases of the project in order to ensure that the individual sub-systems integrate with each other to provide a safe and reliable railway? [20 marks]

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### Question 7

Provide an outline functional performance specification for procuring train detection equipment for use as the basis of a block signalling system. [15 marks]

What are the main advantages and disadvantages of providing a functional performance specification rather than a detailed design specification? [5 marks]

### Question 8

A new railway control centre is being built which will centralise control of a complex line. A voice communication system is to be provided to allow control staff to communicate with drivers.

Describe the process you should adopt in order to identify the system requirements. [10 marks]

Briefly explain how each of the following issues could impact on the design and operation of the voice communication system:

- a) Human machine interface
- AND
- b) Environmental factors
- AND
- c) Interaction with other railway control systems
- AND
- d) Maintenance and installation. [10 marks]

### Question 9

How do the signal engineering design, maintenance and operation of the systems associated with a set of points interact with other railway engineering disciplines? [20 marks]

### Question 10

Explain the human factors to be taken into consideration (from a passenger perspective), when developing the information systems, both visual and audio, for a major surface or underground station. [20 marks]

End Of Paper.