INSTITUTION OF RAILWAY SIGNAL ENGINEERS 2010 EXAMINATION

MODULE 1 - SAFETY OF RAILWAY SIGNALLING AND COMMUNICATIONS

TIME ALLOWED - 1 HOUR

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

Railway Administrations around the world are keen to ensure that new materials and products introduced into signalling and telecommunications systems are safe and reliable and meet certain minimum standards (international standards).

Explain why new materials and products need to be approved for railway use in a country of your choice. State the country you have chosen. [12 marks]

What tests are carried out to determine whether a product meets agreed international standards? [8 marks]

Question 2

What elements should be included in a Competence Management System for the maintenance staff of an operational railway and what benefits would it bring? [12 marks]

How should the Competence Management System be used to reduce the risk of human error? [8 marks]

Question 3

Track circuits may fail to detect the presence of a train and show clear when occupied. Describe three distinct reasons why this may happen and state any assumptions that you make. [12 marks]

What measures can be put in place to reduce the likelihood or mitigate the consequences of each of the reasons that you described above? [8 marks]

Paper continued on next page

Question 4

A train has passed a signal at danger. The driver alleges that the signal displayed a proceed aspect. Describe how you would use data, voice and other recording equipment on the infrastructure and on the train to investigate the incident. [10 marks]

What are the benefits and limitations of using such recording equipment? [10 marks]

Question 5

For each of the following phases in the life of a signalling or telecommunications scheme, describe an example of a potential hazard and possible consequence resulting from uncontrolled documentation:

a) design; and
b) installation; and
c) testing; and
d) maintenance. [12 marks]

Question 6

With the advent of mobile communication technology the continued provision of lineside telephones is being questioned.

What are the advantages and disadvantages of providing lineside telephones? [8 marks]

What hazards are brought about by not providing lineside telephones and how can these be mitigated? [12 marks]

Question 7

The Engineering Safety Management 'Yellow Book' defines a seven-stage risk assessment process:



- a) Explain each stage of the process, including examples of methods which could be used. [10 marks]
- b) "The application of this process to a major signalling or telecommunications project may itself present risks." Discuss this statement. [10 marks]

Question 8

During the testing and commissioning of an alteration to an existing signalling or telecommunications system, a design error is found. Describe the options available to, and the consequential actions of, the testing and commissioning staff in order to ensure that the railway is handed back to the operators in a safe state at the end of the commissioning period.

[20 marks]

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Question 9



A mechanical signal box controls the following track layout:

A freight train has become derailed, occupying the area indicated by the dashed box.

Describe two degraded methods of operation which will allow trains to operate using the unaffected lines. Your answer should identify any risks inherent in each method and any additional measures necessary to mitigate these risks. [20 marks]

Question 10

Describe the environmental factors which may influence the design of signalling or telecommunications equipment which is intended to be installed in:

- a) a secure equipment room
- b) the lineside environment
- c) onboard a train

[12 marks]

Discuss how these factors may affect the specification, selection and approval of equipment for use on the railway. [8 marks]

End of paper