

**INSTITUTION OF RAILWAY SIGNAL ENGINEERS
2008 EXAMINATION**

**MODULE 1 - SAFETY OF RAILWAY SIGNALLING AND
COMMUNICATIONS**

TIME ALLOWED - 1 HOUR

10 MINUTES WILL BE ALLOWED BEFORE THE START TO READ THE PAPER

ANSWER **TWO** 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

Define what is meant by safety related and safety critical systems in relation to railway signalling or telecommunication applications. [6 marks]

Briefly describe two examples of each type of system. [6 marks]

When designing and developing a safety related system, what techniques can be used to:

- a) Minimise failures
and b) Reduce or prevent hazardous effects when failure occurs. [13 marks]

Question 2

Explain, with examples, how 'principles testing' differs from 'functional testing'. [6 marks]

How can a system be designed and installed so that testing is made easier? [6 marks]

What are the major steps in testing and commissioning a new replacement signalling system and decommissioning the existing system? [13 marks]

Paper continued on next page

Question 3

Continued operation of railway traffic is required in the event of a track circuit failure on a plain line section of railway with a conventional lineside signalling system.

Describe two methods of degraded mode operation to achieve continued operation, one that relies purely on operating rules and procedures, the other utilising a technological fall back system for continued operation. [8 marks]

How does each solution ensure safety during the continuing operation of traffic? For each solution, identify and explain any significant risks and any control measures necessary to ensure safety. [12 marks]

How would each solution affect traffic capacity? [5 marks]

Question 4

Using a system of your choice as an example, explain why configuration management is necessary through the whole life of railway signalling and telecommunications systems and summarise how configuration may be managed. [10 marks]

You are required to develop a configuration management plan for a railway project that will incorporate both hardware and software design. This plan must identify the ways in which configuration management will be controlled during the project's life. Describe the areas that should be included in this plan and summarise how their configuration should be managed. [11 marks]

How may the management method change during the lifecycle? [4 marks]

Question 5

A 36-hour line closure is planned for final installation, testing and commissioning of a new signalling or trackside telecommunications system.

(a) Describe the principal activities which would take place during the commissioning period. [5 marks]

(b) Considering the range of activities which you have described in part (a), identify the main risks to staff safety and describe any mitigating measures which may be necessary. [10 marks]

(c) Describe the documentation which should be produced prior to the commissioning in order to ensure the safety of the commissioning staff and explain how the documentation you have described ensures this. [10 marks]

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Question 6

What are the main challenges which face railway administrations or equipment manufacturers seeking to introduce new technology onto existing railways? [5 marks]

Briefly, explain how these challenges may be overcome. [5 marks]

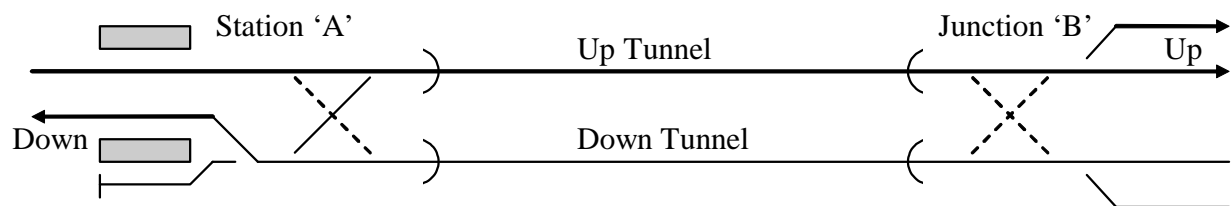
Select ONE of the following examples:

- (i) A radio system replacing a lineside telephone system, OR
- (ii) An LED unit replacing a filament signal lamp.

For your chosen example, briefly describe the advantages and disadvantages of both old and new systems, identify the main risks associated with the introduction of the new system, and describe any action necessary to mitigate those risks. [15 marks]

Question 7

It is proposed to modify the railway shown in the following diagram by installing additional crossovers at 'A' and 'B', as indicated by the dotted lines, to permit single-line working through either of the two single-bore tunnels.



Identify the main operational and staff safety risks associated with the proposed changes to the railway, and describe any systems which may be provided to mitigate these risks. [25 marks]

Question 8

A railway uses an in-cab transmission-based signalling system, with a limited number of lineside signals also provided to enable a degraded mode of operation.

- (a) Describe the process you would follow to identify the risks associated with the maintenance of the lineside signalling equipment. [6 marks]
- (b) Identify the main risks associated with the maintenance of the lineside signalling equipment. Your answer should consider both planned and unplanned maintenance activities. [8 marks]
- (c) Describe the management processes which should be adopted to minimise the risk of disruption to train services caused by failures of the signalling system, and discuss the impact of these processes on the risks identified in part (b). [11 marks]