# INSTITUTION OF RAILWAY SIGNAL ENGINEERS 2010 EXAMINATION

### **MODULE 6 – COMMUNICATION APPLICATIONS**

## TIME ALLOWED – 1 1/2 HOURS

#### 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

A data transmission network is required to support an electronic interlocking system, voice services, station information systems and CCTV for a remote passenger railway station. The control centre is located 100km from the remote railway station. The interlocking is located at the remote railway station.

- a) Describe, with the aid of sketches, a suitable data transmission network for the operation of the systems. [20 marks]
- b) What options are available to mitigate the effect of failure of the transmission system between the control centre and the remote railway station, and failure of equipment at the control centre itself? [5 marks]
- c) How would you ensure that the safety integrity of signalling data is protected at all times? [5 marks]

#### **Question 2**

A radio base station has been reported as suffering from interference.

- a) Discuss what the possible causes of interference may be. [10 marks]
- b) How should you go about investigating the cause of the interference. [10 marks]
- c) Suggest possible solutions for at least three of the causes you discussed in part a).

[10 marks]

Paper continued on next page.

#### **Question 3**

A railway telecoms network consists of TDM based SDH transmission equipment running over optical fibre. The fibre cables and the SDH equipment are not life expired.

- a) Describe how the equipment and fibre could be expanded / enhanced to carry high bandwidth IP data for multiple applications. Your answer must include network management and service provision. [20 marks]
- b) What are the considerations that must be taken into account for signalling applications that will need to be carried over the new IP telecoms network? [10 marks]

#### **Question 4**

Describe the options available for providing a low cost, real time passenger information system for a small remote station. Your answer must include the station equipment, human factors, and transmission options, together with operational and maintenance considerations.

[30 marks]

#### **Question 5**

Describe the technical and ergonomic considerations of designing an integrated building / station management system for a large mass transit or suburban railway station. Identify all the station systems and applications that may need to be managed by the system. [30 marks]

#### Question 6

Detail the design considerations that are required for telecommunications circuits supporting safety related functions, such as computer based interlockings and axle counters.

[15 marks]

Describe a testing strategy to ensure the integration of these telecommunications circuits. [15 marks]

#### **Question 7**

Draw a diagram to illustrate a design configuration for the distribution of power supplies to a remote equipment room containing radio, transmission and switching systems. [10 marks]

Discuss your design and its safety, including reliability and availability. [20 marks]

End of paper.