INSTITUTION OF RAILWAY SIGNAL ENGINEERS
2010 EXAMINATION

MODULE 4 – COMMUNICATION PRINCIPLES

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

What is the difference between the frequency response of the human ear, compared to the normal range of a telephone transmitter receiver bandwidth. Your answer should explain what the accepted ranges are for both human ear and telephone transmitter receiver, and the limitations that apply to the latter. [5 marks]

Explain how the telephone bandwidth is converted into a digital signal suitable for transmission over a digital transmission system. [25 mark]

Question 2

Telecoms transmission using copper cable is used extensively in railway systems; however transmission quality can be influenced by various external factors. Discuss the issues that impact on the transmission quality. [30 marks]

Question 3

Internet Protocol (IP) transmission type systems are replacing traditional Time Division Multiplex (TDM) transmission systems.

a) Explain the difference between IP and TDM systems. [10 marks]

b) List and explain the OSI model layers, giving an example of how the model can be used to explain the various layers in an access and core IP transmission system [10 marks]

c) Explain the advantages and disadvantages of IP transmission compared to TDM transmission. [10 marks]

Paper continued on next page.

Question 4

Explain how the telecommunications systems would be affected by an AC electrified railway for each of the following feeding configuration.

a) Auto Transformer [5 marks]
b) Booster Transformer [5 marks]
c) Return Conductor only [5 marks]
d) Running Rail Return [5 marks]

How would the telecommunications design differ for each of the feeding configurations. [5 marks]

What methods of immunisation would be required to compensate for each of the four configurations in order to ensure safe and reliable operation? [5 marks]

Question 5

With the aid of a diagram describe all the component parts of a GSM-R system. [15 marks]

List and explain all the functions of a GSM-R system which are additional to those of a public GSM system. [15 marks]

Question 6

What are the engineering, physical and ergonomic considerations that need to be taken into account to ensure that the quality of a CCTV picture is to an acceptable standard from a platform mounted camera used for Driver only Operation? [15 marks]

What are the additional considerations that need to be taken into account for a system to transmit and display the pictures into the cab of a train? [15 marks]

Question 7

Discuss the considerations which must be taken into account when designing the location and size of radio sites for a track to train secure radio data and voice communication system. [15 marks]

What are the differences that need to be considered in planning radio coverage, both data and voice, in a railway radio system compared with a public network? [10 marks]

How would you go about verifying that the coverage specification is met? [5 marks]

End of paper.