

**INSTITUTION OF RAILWAY SIGNAL ENGINEERS
2008 EXAMINATION**

MODULE 4 – COMMUNICATION PRINCIPLES

TIME ALLOWED – 1 1/2 HOURS

10 MINUTES WILL BE ALLOWED BEFORE 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

With the aid of a diagram, describe the construction and the component parts of a fibre optic cable used within the railway environment.

[5 marks]

Describe the characteristics of, and differences between, monomode and multimode fibre optic cable.

[10 marks]

Describe how the capacity of a fibre optic cable can be increased by the use of DWDM and CWDM and explain the differences between the two technologies.

[15 marks]

Question 2

What factors must be considered when planning a wireless LAN?

[5 marks]

With the aid of a table, compare the characteristics of the 802.11 family of wireless protocols, including details of suffix, data rate and frequency band.

[10 marks]

Describe the advantages and disadvantages of each protocol.

[5 marks]

Explain and discuss the options for adding security to a wireless LAN.

[5 marks]

Why is security so important?

[5 marks]

Paper continued on next page.

Question 3

With the aid of a diagram, outline the principles of a d.c. overhead line system associated with a main line, light rail or tram system of your choice.

[5 marks]

Describe what effects the d.c. overhead line system could have on any parallel audio and data telecommunication systems, external services such as gas, water, electricity and any nearby metal structures.

[10 marks]

What testing would you consider to determine the level of impact on the external system?

[8 marks]

What actions should be considered to minimise any of the issues identified?

[7 marks]

Question 4

Define the term 'electrical noise' with respect to railway communication systems including likely causes.

[10 marks]

What equipment should you use to measure and analyse electrical noise and what results should you expect to get from a typical test carried out over a period of 24 hours?

[10 marks]

Outline the design considerations to minimise the effects of the electrical noise within the system and any noise the system may receive.

[10 marks]

Question 5

Power Condition Monitoring, especially at remote network sites, forms a key part of modern telecommunications systems associated with main line, suburban, light rail or metro railways.

Explain why Power Condition Monitoring is important, who needs what information, and why?

[10 marks]

With the aid of a detailed diagram, design a simple power supply system to support a typical, modern GSM-R BTS site. Clearly identify the elements which need to be monitored and how you would achieve this activity at a remote control centre.

[20 marks]

Paper continued on next page.

Question 6

Describe what is meant by the term CCTV (Closed Circuit Television) and provide an outline of its possible applications within the railway environment.

[5 marks]

With the aid of a diagram, outline the design and describe the function of all major components of a CCTV surveillance system that could be used to monitor passenger traffic flow at a railway station.

[15 marks]

Describe the technology choices available that could be used to transmit video images from the railway station to a control centre.

[10 marks]

Question 7

Provide a definition of PCM (Pulse Code Modulation).

[5 marks]

With the aid of diagrams, describe how a number of analogue voice signals can be digitally represented as binary PCM data for transmission via a 2Mbit/s bearer.

[15 marks]

Describe some of the advantages that digital transmission has over analogue transmission techniques.

[10 marks]

End Of Paper.