



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

- COURSE NAME : TRAIN COMMUNICATION AND
SIGNALLING SYSTEM
- COURSE CODE : BNT 20703
- PROGRAMME CODE : BNT
- EXAMINATION DATE : JULY 2024
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS
CONDUCTED VIA
 Open book
 Closed book
 3. STUDENTS ARE **PROHIBITED** TO
CONSULT THEIR OWN MATERIAL
OR ANY EXTERNAL RESOURCES
DURING THE EXAMINATION
CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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Q1 (a) Multi aspect signalling in railway is important for a smooth and safe movement of a train on the track.

(i) Differentiate between 3-aspect and 4-aspect railway signalling.

(5 marks)

(ii) Figure Q1.1 shows the Signal Aspect Sequence. Distinguish the scenario that would have taken place for each of the aspect (S1 to S8). You may use Train 1, Train 2, Train 3 and Train 4 in your explanation.

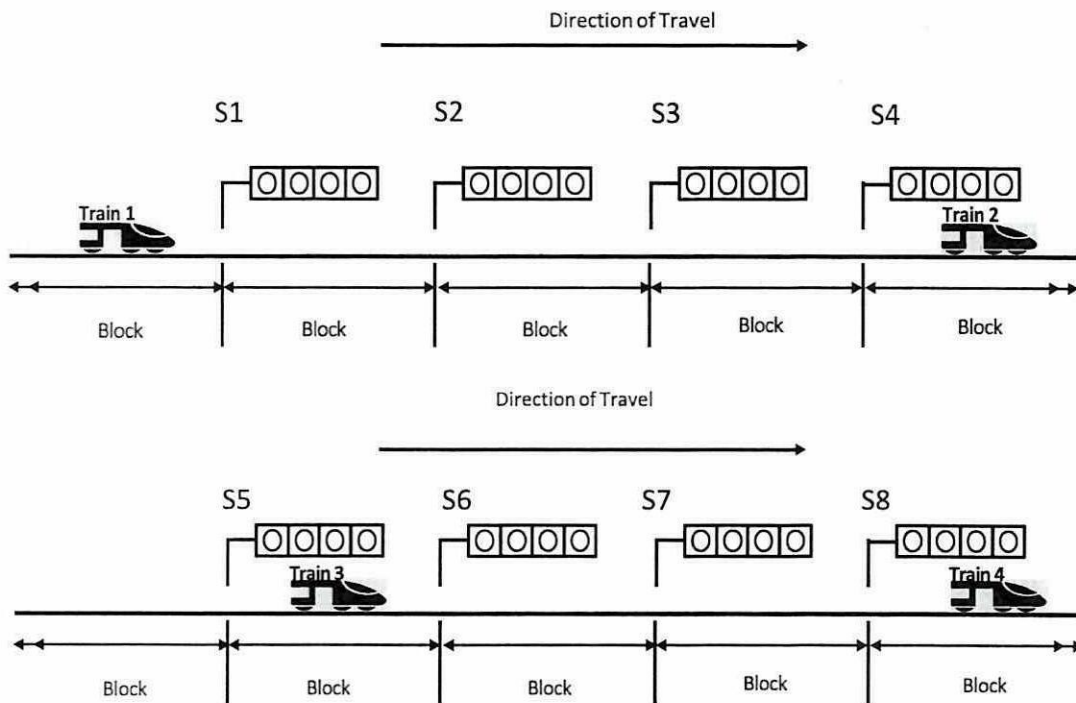


Figure Q1.1: Signal Aspect Sequence

(8 marks)

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- (b) Railway interlocking prevents conflicting movements among trains, through the arrangement with other track devices such as junctions and crossings. By referring to **Figure Q1.2** below, demonstrates the interlocking decision that need to be taken by a signalling engineer in order to make Train 1 to proceed to the branch line without any problem.

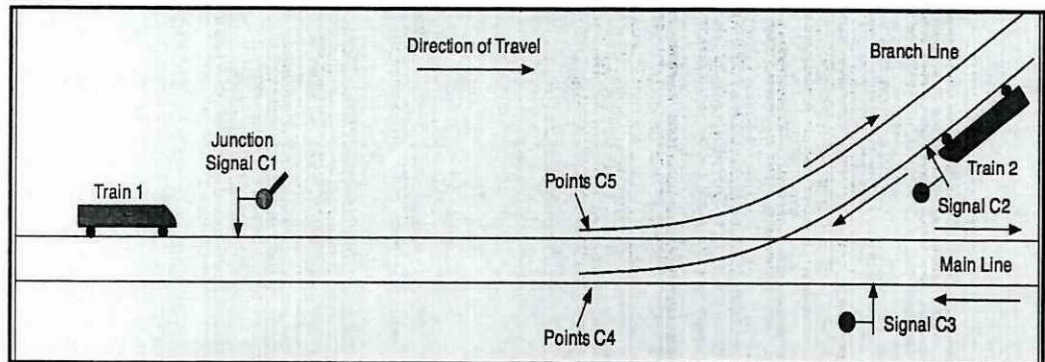


Figure Q1.2: Multiple Junctions and Crossings

(7 marks)

- Q2** (a) Track circuit is a type of train detection system to monitor the presence of a train on the railway track. Outline the function and operation of the track circuit in order to have fail-safe operation.
- (b) Braking system is one of the most important element in railway signalling. Without proper braking system, the rail operator cannot provide a safe and efficient service. Distinguish the factors that the signalling engineer need to consider in order to calculate the safe braking distance.
- (c) Headway is termed as minimum time or distance between two following trains that the signalling permits. For the given parameters below, calculate the headway time for the train speed of 100 km/hr.

(8 marks)

(5 marks)

Train deceleration = 0.85 m/s^2

Train length = 200 m

Signal sighting = 10 seconds

Overlap length = 183 m

Brake delay = 10 seconds

(7 marks)

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- Q3** (a) Normal day-to-day operational verbal communication includes the use by signallers to give instructions to train drivers to move their trains in the event of a signalling system failure or so. With this, it is known that the Operational Telecom System have **FOUR (4)** roles in railway. Discuss them in detail. (6 marks)
- (b) Wireless communication is a medium to transfer the communication information between two or more points without the use of an electrical conductor, optical fibre or other continuous guided medium. Distinguish the advantages of wireless communication medium than other physical mediums. (6 marks)
- (c) Global System for Mobile Communication – Railway (GSM-R) is a radio communication system offering a wide range of voice and data services needed for daily operations of railways. By referring to **Figure Q3.1**, illustrate the operation of the GSM-R to identify the location of any train.

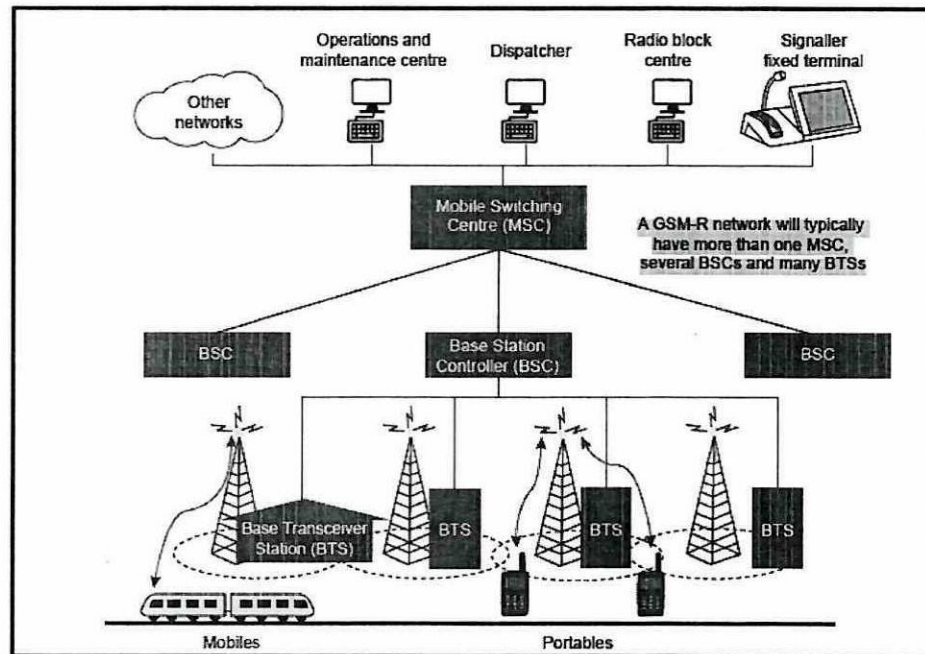


Figure Q3.1: Global System for Mobile Communication – Railway (GSM-R)

(8 marks)

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- Q4** (a) Circuit Switching is a communication method where a dedicated communication path, or circuit, is established between two devices before data transmission begins. Whereas, Packet Switching is a communication method where data is divided into smaller units called packets and transmitted over the network. In your understanding, analyse the advantageous of Packet Switching over Circuit Switching. (8 marks)
- (b) Voice over Internet Protocol (VoIP) VoIP systems offer many advantages compared to a traditional circuit switched telephone exchange network, as voice. One way of explaining the various IP protocols and layers is to map Transmission Control Protocol / Internet Protocol (TCP/IP) and its supporting protocols against the Open Systems Interconnection (OSI) model. Detail out the IP protocols and its' layers which is used to map the TCP/IP supporting protocols. (8 marks)
- (c) In tropical country like Malaysia, many railway tracks has to go through tunnel or underground. In the context of communication, possibility of lost of signal (i.e. multipath) is very paramount after the train enters the tunnel. In your understanding, please justify how this issue can be tackled or resolved. (4 marks)
- Q5** (a) Electrical contact between the rail and the wheel is critical to the operation of track circuits. Discuss on the effect that can cause the rail head contamination. (4 marks)
- (b) EMI or Electromagnetic Inteference is the unintentional generation of RF signals by electronic equipments. EMI can be caused by any source of AC current. Identity and discuss on the sources that can cause EMI in railway. (6 marks)
- (c) Secondary system in railway signalling is meant to provide independent means to continue to move the trains (in a degraded mode), pending recovery from service-affecting failures of the primary signalling system. Explain in detail the **FIVE (5)** secondary systems – which is termed as Grade of Secondary System (GoSS). (10 marks)

- END OF QUESTIONS -

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