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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : TRAIN COMMUNICATION AND  
SIGNALLING SYSTEM

COURSE CODE : BNT 20703

PROGRAMME CODE : BNT

EXAMINATION DATE : JULY / AUGUST 2023

DURATION : 3 HOURS

INSTRUCTIONS :

1. ANSWERS **ALL** QUESTIONS.
2. THIS FINAL EXAMINATION IS  
CONDUCTED VIA **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 **FOUR (4)** PAGES

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- Q1**
- (a) A train has to be given the Moving Authority (MA) before the driver is allowed to 'drive' the train in the permissible rail track in order to avoid any derailment or collision. Detail out the measures that can be taken in order to avoid derailment or collision. (5 marks)
- (b) Differentiate between 3-aspect and 4-aspect railway signalling. (5 marks)
- (c) 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. (8 marks)
- (d) 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.
- |   |                        |
|---|------------------------|
| Train deceleration = $0.85 \text{ m/s}^2$ | Train length = 200 m   |
| Signal sighting = 10 seconds              | Overlap length = 183 m |
| Brake delay = 6 seconds                   |                        |
- (7 marks)
- Q2**
- (a) In comparison between signalling and communication in railway, there is a very famous quote, 'We can run trains without signalling, but we cannot run trains without communication'. Analyse the statement above with strong justification. (5 marks)
- (b) Fiber optic or optical fiber cables are becoming as more efficient for communication system, as a whole. Distinguish the advantages of optical fibre cables compared to other cable bearers. (4 marks)
- (c) Transmission systems are used to transmit and receive more information than a single cable pair or fibre over long distances. For digital communication, mainly 2 switching methods will be used; circuit switching and packet switching. Differentiate between circuit switching and packet switching. (8 marks)
- (d) By referring to **Figure Q2(d)** (Open System Interconnection (OSI) model), explain all the IP protocols and its' layers which is used to map the TCP/IP supporting protocols. (8 marks)

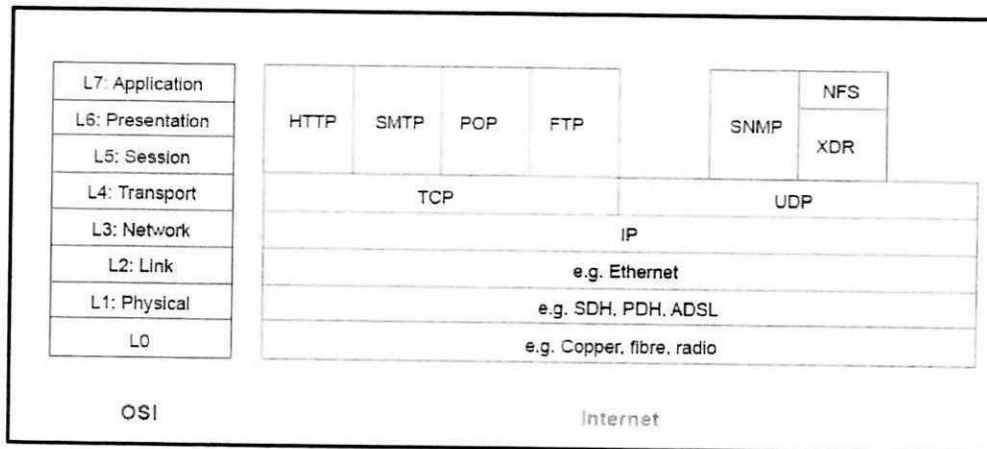
- Q3** (a) Identify **FOUR (4)** roles needed for a successful telecom operational in railway system. (4 marks)
- (b) Closed-circuit television (CCTV) system should be included in the planning and design stage of any new facility, building or asset.
- (i) List out the factors that need to be considered for a good CCTV system design. (5 marks)
- (ii) Design and explain basic CCTV operation for a typical railway station. (8 marks)
- (c) Satellite communication has started to venture the railway industry, whereby it is being used to identify the location of the train to replace the conventional signalling method. By referring to **Figure Q3(c)**, explain the operation of the GSM-R (Global System for Mobile Communication – Railway) to identify the location of any train. (8 marks)
- Q4** (a) Supervisory Control and Data Acquisition (SCADA) systems can be used to monitor and control many different processes and systems for railway. Explain your understanding about the SCADA system in the Operational Control Centre (OCC). (4 marks)
- (b) 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)
- (c) There are significant number of environmental factors that may impact on the safe and reliable operation on the railway signalling system. Detail out and discuss on each of them. (6 marks)
- (d) EMI or Electromagnetic Inteference is the unintentional generation of Radio Frequency (RF) signals by electronic equipments. Identity and recommend some common techniques that can be employed to reduce or protect from EMI emissions. (5 marks)

- END OF QUESTIONS -

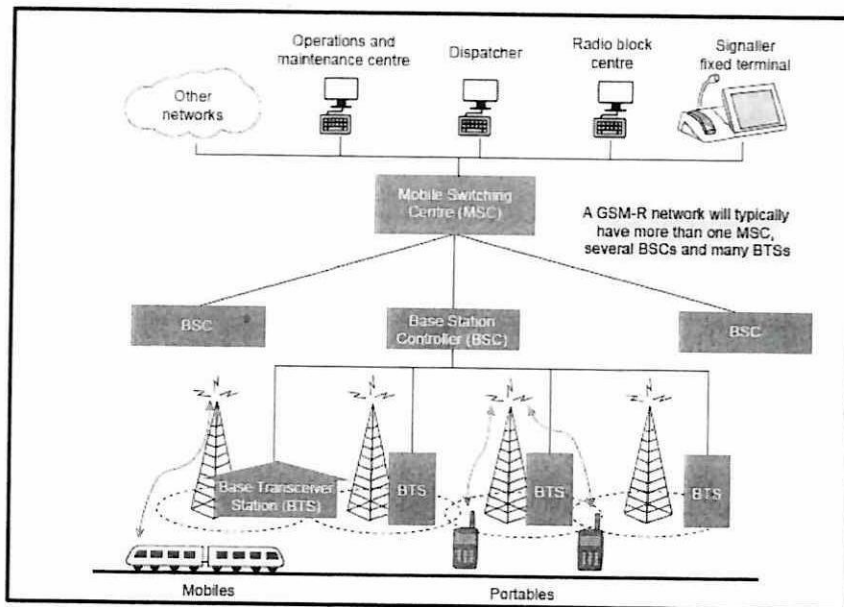


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**Figure Q2(d) : Open System Interconnection (OSI) model**



**Figure Q3(c): Typical Global System for Mobile Communication – Railway (GSM-R) network**

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