



UNIVERSITI KUALA LUMPUR
MALAYSIA ITALY DESIGN INSTITUTE

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE : PWB30203
COURSE TITLE : RAILWAY SIGNALING
PROGRAMME NAME : BACHELOR OF ENGINEERING TECHNOLOGY (RAILWAY SYSTEM)
WITH HONOURS
DATE : 23 JUNE 2026
TIME : 9:00AM - 11:30AM
DURATION : 2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of ONE sections.
4. Section A consist of five questions. Answer FOUR (4) questions only.
5. Please write your answer on the answer booklet provided.
6. Please answer all questions in English only.
7. Refer to the attached Formula/ Appendies. ☐ Tick if applicable

THERE ARE 6 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 100 marks)

Answer FOUR (4) questions.

Please use the answer booklet provided.

Question 1

Railway signaling equipment is a complex, failsafe network of systems designed to manage train spacing (blocks), control junction routing, and prevent collisions . It operates on a strict "fail-safe" philosophy, meaning any equipment malfunction automatically defaults to the most restrictive (stop) signal.

- (a) Railway signal aspects provide essential movement authority to train drivers. Explain the meaning of Red, Yellow, and Green signal aspects in terms of train movement authority and operational safety.

(5 marks)

- (b) Describe the function of a point machine in railway interlocking systems. With reference to safe train operation, explain how a point machine changes and locks the route for train movement.

(7 marks)

- (c) Explain the purpose of a track circuit in railway signaling systems. Describe in detail how a track circuit detects train occupancy and ensures safe train separation. Include the electrical principle involved.

(7 marks)

- (d) Explain how signal aspects, point machines, track circuits, and shunt signals interact within an interlocking system to ensure fail-safe train operations.

(6 marks)

Question 2

Train detection is a critical railway signaling process used to determine the presence, location, and speed of trains along a track . It prevents collisions, controls level crossing gates, and monitors track occupancy to maintain safe, efficient railway networks

- (a) State the main function of axle counter in railway signalling system. Axle counter consist of three (3) basic elements. Identify and explain the function of each type of these elements. With the help of Figure shown below, briefly explain the process of detection and the process to report the status of the occupancy of the track sections before the data submitted to the control room.

Refer Below - Figure1 : Axle Counter System .

(10 marks)

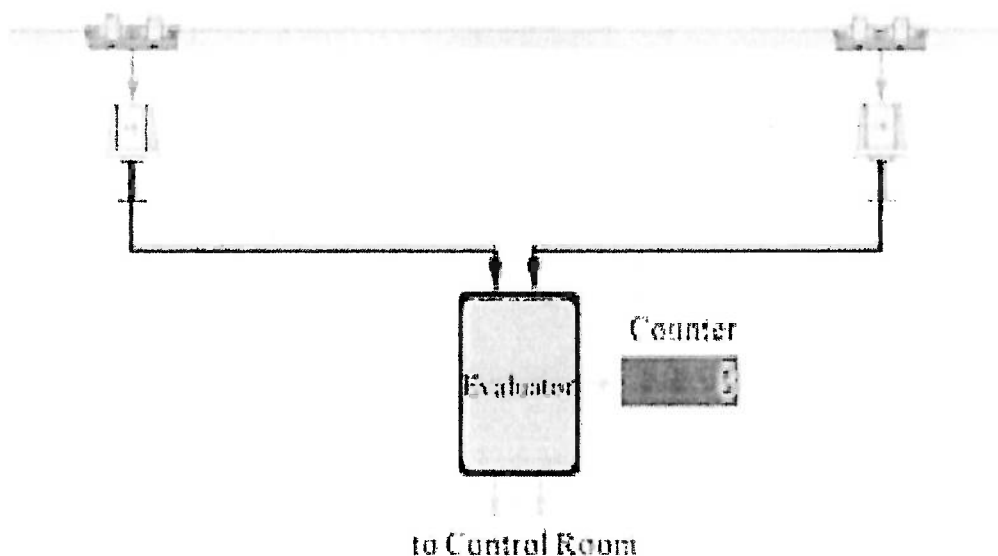


Figure 1: Axle Counter System

- (b) However, several faults still occur during the exertion of the axle counter. Identify any two(2) of these faults and explain how to overcome the faulty. State and explain the process of detection for another field equipment that also can be used as train detection system.

(15 marks)

Question 3

In Communications-Based Train Control (CBTC) systems, PPHPD (Passengers Per Hour Per Direction) is the fundamental metric used to measure and optimize route capacity. It determines how effectively a transit system can move people during peak hours and justifies the massive infrastructure costs of modernizing urban rail networks.

- (a) Briefly explain the meaning of Fixed Block, Moving Block, Dwell Time and Movement Authority in railway system.

(10 marks)

- (b) In a fleet of 2-car configuration vehicles for an LRT system, each car is designed with the same size and can accommodate a maximum capacity of 200 passengers. It is intended to run the service at headway of 5 minutes during peak hours. Therefore, determine the Passengers Per Hour Per Direction (pphpd) of this system.

Note: $PPHPD = VPH * CAP_{max}$ or $60/INT * CAP_{max}$;

(5 marks)

- (c) If the ridership has increased into 8500 pphpd, determine the headway required to ensure that all the passengers can embark into the transit system.

(5 marks)

- (d) After 7 years of operations, the LRT system is fully congested although the headway has been reduced into 1.5 minutes. It is noted that the line capacity has been increased into 18000 pphpd. Due to limitation of power system and number of available vehicles, determine number of cars required to meet the capacity demand.

(5 marks)

Question 4

In Malaysia, the railway network is divided into mainline (intercity) and urban (metro/suburban) systems. Mainline railways span the country, while urban lines cater specifically to densely populated city corridors and suburbs, predominantly in the Klang Valley (Greater Kuala Lumpur).

- (a) Briefly explain the meaning of moving block and fixed block in railway system and explain the advantage of using moving block system.

Safety integrity level (SIL) is defined as a relative level of risk-reduction provided by a safety function, or to specify a target level of risk reduction. Identify the SIL for interlocking system and give one reason for your selection.

(8 marks)

- (b) State the meaning of 'fail-safe' in railway system. Briefly explain the Hot Standby and the 2oo2 architectures used in railway signaling systems. State one advantage of each system.

(9 marks)

- (c) State the main function of interlocking system. Also define which generation of the interlocking possibly using 2oo2 system.

(8 marks)

Question 5

CityFlo-650 signaling system was designed by Bombardier Transportation is used in MRT lines, SBK line (Sungai Buloh Kajang line) and also will be used in SSP line (Sungai Buloh Serdang Putrajaya line).

- (a) This signaling system is called Communication Based Train Control (CBTC). Briefly explain the purpose of this system. Elaborate any two (2) operational strengths and weaknesses of using this system.

(10 marks)

- (b) Automatic Train Operation (ATO) and Automatic Train Supervision (ATS) are part of the CBTC architecture. Briefly explain the role of ATO and ATS in maintaining safe train regulation.

(8 marks)

- (c) In Communication-Based Train Control (CBTC) systems, legacy data communication with the Operations Control Center (OCC) was achieved using radio transmission and loop transmission. Briefly explain these two transmission methods.

(7 marks)

END OF EXAMINATION PAPER