UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	RAILWAY MAINTENANCE
COURSE CODE	:	BNT 42303
PROGRAMME CODE	:	BNT
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTION	:	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 **THREE (3)** PAGES

Q1 (a) Railway maintenance encompasses a wide range of tasks and activities aimed at preserving the operational integrity of rail infrastructure. The types of railway maintenance includes Preventive Maintenance (PM), Corrective Maintenance (CM), Predictive Maintenance, Reliability-Centred Maintenance (RCM) and Design-Out Maintenance (DOM).

(i) List **THREE (3)** importance aspects of railway maintenance.

(3 marks)

(ii) Explain each type of railway maintenance as stated in **Q1(a)**.

(10 marks)

(b) As public transportation infrastructure and related systems become increasingly complex, systems assurance confirms that rail and transit systems function as intended during their full life cycle. Examine Reliability, Availability, Maintainability, and Safety (RAMS) best practices in relation to System Assurance in Rail.

(12 marks)

Q2 (a) The maintenance department serves as the backbone of operational continuity and efficiency across various industries.

(i) Interpret **FOUR (4)** specific functions and responsibilities of the maintenance department within railway operations and maintenance.

(8 marks)

(ii) Demonstrate **THREE (3)** elements of effective maintenance management.

(9 marks)

(b) Job planning and scheduling are integral aspects of effective project management, ensuring tasks are completed efficiently and within designated timelines. By employing methods such as the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT), project managers can strategically plan and sequence activities, identify critical tasks, allocate resources optimally, and mitigate potential delays or bottlenecks. Distinguish **FOUR (4)** basis of CPM and PERT.

(8 marks)

Q3 (a) Safety Integrity Level (SIL) is a measure of the reliability of safety functions in a system. Explain the concept of SIL and its importance in ensuring the safety of railway operations.

(9 marks)

(b) Using a specific example from railway signalling systems, describe the way of Safety Integrity Level (SIL) is applied to assess the reliability and safety performance of safety-critical components such as interlocking systems or level crossing protection.

(8 marks)

(c) Analyze **FOUR (4)** potential consequences of inadequate Safety Integrity Level (SIL) compliance in railway systems.

(8 marks)

Q4 (a) The railway industry is currently investing in condition monitoring technologies in order to achieve lower failure rates and provide better service. Analyze the role of predictive maintenance technologies, such as condition monitoring and remote diagnostics, in improving the reliability and efficiency of railway operations.

(8 marks)

(b) Analyze the effectiveness of different maintenance scheduling strategies (e.g., preventive maintenance, condition-based maintenance) in minimizing downtime and optimizing asset performance in railway systems.

(8 marks)

(c) Discuss **THREE (3)** roles of digital twin technology application in railway maintenance monitoring systems.

(9 marks)

- END OF QUESTIONS –