UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME : RAILWAY MAINTENANCE

COURSE CODE : BNT 42303

PROGRAMME CODE : BNT

EXAMINATION DATE : JULY 2022

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER **FOUR (4)** FROM **FIVE (5)** QUESTIONS

2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**

3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

BNT 42303

Q1 Railway may be defined as a high value, fixed guidance land transport system, carrying passengers and freight in purpose-built containers, using specifically designed, high power traction systems and controlled by high integrity safety systems.

    (a) Using appropriate illustrations explain **FOUR (4)** different approaches to maintaining a railway asset or services.

<div align="right">(6 marks)</div>

    (b) What are the advantages and disadvantages of centralized maintenance?

<div align="right">(4 marks)</div>

    (c) Citing the pros and cons, describe 'Reliability-centred maintenance (RCM)'.

<div align="right">(5 marks)</div>

    (d) Discuss, citing appropriate examples in the railway industry, the **FIVE (5)** essential steps towards effective maintenance management.

<div align="right">(10 marks)</div>

Q2 If a railway service is to be reliable and safe, the equipment must be kept in good working order and regular maintenance is the essential ingredient to achieve this.

    (a) Describe the rail transportation planning process activities at strategic, tactical and operational levels.

<div align="right">(9 marks)</div>

    (b) Citing examples, explain the role of Systems Assurance in Rail.

<div align="right">(4 marks)</div>

    (c) Tabulate and discuss **THREE (3)** Digital Railway technologies and their respective benefits.

<div align="right">(12 marks)</div>

Q3 A railway MRO company is bidding on a major repair on a railway line. The project consists of activities listed in **Table Q3**.

    a) Compare the difference between the Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT).

<div align="right">(6 marks)</div>

    b) Draw the project network diagram using a forward pass and determine the critical path.

<div align="right">(8 Marks)</div>

c)   Determine the Total Project Completion Time Using a Backward Pass.

(4 Marks)

d)   Determine the Slack for each Activity.

(4 Marks)

e)   Explain how you might use the network approach to help prepare cost estimates.

(3 Marks)

Q4   In the case of a railway system the term 'safety' describes the guarantee, through the constituents and the components of the railway system, that during operation the risk level is not described as 'non-permissible'. (European Standard EN50126-1, 2000; EC, 2009).

(a)   Explain by including examples, of the **FOUR (4)** risk levels below.

(i)   Non-permissible,
(ii)   Non-desirable,
(iii)   Permissible,
(iv)   Unimportant.

(6 marks)

(b)   Illustrate by giving **TWO (2)** examples of each of the causes of accidents in the following classifications.

(i)   Railway infrastructure,
(ii)   Rolling stock,
(iii)   Operation,
(iv)   External causes

(8 marks)

(c)   Define Safety Integrity Level (SIL).

(3 marks)

(d)   Using an appropriate diagram and flowchart, describe the application of FMEA analysis to assess the safety of railway vehicles.

(8 marks)

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Q5 Automated condition evaluations with forecasting based on existing data from diagnostic systems are the next step in the enhancement process of maintenance systems.

(a) Explain the essence of the implementation of condition-based maintenance.

(6 Marks)

(b) Using appropriate illustrations, describe the typical diagnostic system for railway condition-based maintenance in the categories below.

(i) Track measurement,
(ii) Vehicle dynamics measurement,
(iii) Vision systems,
(iv) Video inspection.

(10 marks)

(c) Using an appropriate diagram, explain the benefits and the various functions of the Computerized Maintenance Management System (CMMS).

(9 marks)

-END OF QUESTIONS –

Table Q3

Activity	Immediate Predecessor	Duration (Days)
A	—	3
B	A	4
C	A	2
D	B	5
E	C	1
F	C	2
G	D, E	4
H	F, G	3