Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	TRAIN CONTROL SYSTEM
COURSE CODE	:	CNR 10303
PROGRAMME CODE	:	CNR
EXAMINATION DATE	:	JANUARY/ FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK**

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1 (a) Justify the implementation of distributed architecture for signalling systems compared to centralized architecture in most urban rail CBTC systems in Malaysia.

(10 marks)

(b) Differentiate between legacy signalling system and communication-based train control (CBTC) system.

(5 marks)

(c) The Rapid Transit System (RTS) line is expected to reduce traffic congestion between Johor Bahru and Singapore. Propose a complete signalling system for the JB-SG RTS that can provide high volume, fast and efficient transportation system between the two stations.

(10 marks)

Q2 (a) Switches, crossings and point machines are the major components in Switch and Crossing (S&C). Explain the function of all **THREE (3)** switch and crossing components

(6 marks)

(b) Switches and crossings highly affect the maintenance cost of the rail network

(i) Discuss on how S&C technology has evolved throughout the past century and how this technology will evolve in the future.

(5 marks)

(ii) Suggest the main cost driver in the S&C and recommend on the approach to minimize cost while improving reliability.

(5 marks)

(c) Interlocking system is considered as one of the major breakthroughs in railway. Identify **THREE (3)** main improvements in railway by introducing interlocking and produce evidence for each point.

(9 marks)

Q3 (a) Reliable, fail-safe train detection serves as the foundation for railroad signaling. Track circuit and axle counter have been used to detect train occupancy. With the aid of a table, differentiate track circuit and axle counter that could include in terms of their functional scope, compatibility, installation, maintenance and cost.

(8 marks)

(b) The European Train Control System (ETCS), continuously calculates a safe maximum speed for each train, with cab signalling for the driver and on board systems that take control if the permissible speed is exceeded. Explain and illustrates **THREE (3)** levels of ETCS based on the ETCS data transmission, trackside equipment and train borne systems according to different ETCS levels.

(9 marks)

(c) Justify the feasibility of the European Railway Traffic Management System (ERTMS) implementation for the mainline rail network in Malaysia. Provide at least **THREE (3)** points with elaborations.

(8 marks)

Q4 (a) The concept of automated systems can be applied to various levels of train operations. Organize with the aid of a diagram, **FOUR (4)** grades of automation based on the type of operation system.

(8 marks)

(b) Describe the following terms:

(i) Automatic Train Control (ATC)

(2 marks)

(ii) Automatic Train Operation (ATO)

(2 marks)

(iii) Automatic Train Supervision (ATS)

(2 marks)

(iv) Automatic Train Protection (ATP)

(2 marks)

(c) Supervisory Control and Data Acquisition (SCADA) is an industrial computer-based control system employed to gather and analyse the real-time data to keep track, monitor and control sensors and actuator in train and transport industries. Figure out the architecture of SCADA that suits railway application and support your discussion with the aid of a diagram.

(9 marks)

- END OF QUESTIONS –