

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CIVIL & WATER ENGINEERING

FACULTY OF INDUSTRIAL TECHNOLOGY

BACHELOR OF ENGINEERING (HONOURS) DEGREE

PART III SECOND SEMESTER EXAMINATION – MAY 2014

TRANSPORTATION ENGINEERING & PLANNING II – TCW 3202

INSTRUCTIONS: Answer **FOUR** questions including at least one from **Section B**.

Time allowed: 3 hours

Total marks: 100

All questions carry 25 marks each

SECTION A

QUESTION 1

- a) Name two types of rail sections commonly used and draw a fully labelled sketch of one of them. **(6 marks)**
- b) Rail expansion joints are subject to operational deterioration. Define the following and explain how they contribute to creep of rails.
- Wave theory
 - Percussion Theory
 - Drag Theory
- (9 marks)**
- c) Describe 5 ways of identifying creep in rails and 5 ways of addressing the creep that occurs on an operational track. **(10 marks)**

QUESTION 2

- i) Outline the duties of the following at a marshalling or exchange yard:
- plate layer
 - signaller
 - yardmaster

(6 marks)

ii) With the aid of sketches where appropriate, define the following railway terms:

- shunting
- siding
- controlled yard
- ladder track
- buffer zone

(10marks)

iii) In point format, using appropriate sketches, describe the mechanism by which a train switches tracks and the accompanying safety features both on the train and the permanent way which ensure that the train does not derail during this manoeuvre.

(9 marks)

QUESTION 3

a) Define the following terms:

- Ruling Gradient
- Grade Resistance
- Grade Compensation

(6 marks)

b) i) Assuming a grade compensation of 0.03% per degree of curvature, calculate the required Ruling Gradient for a medium gauge with a 4 degree curvature on a 1 in 250 gradient (Data: $G = 1.097\text{m}$)

(6 marks)

ii) Differentiate between Equilibrium Cant and Cant Deficiency

(5 marks)

iii) Calculate the safe speed on a 1000m radius curved section of a metre gauge track with a super-elevation of 80mm

(8 marks)

QUESTION 4

a) Evaluate the safety systems of an ideal railway system writing brief notes on each of the following contributing aspects:

- Signalling
- Level crossings
- Railway servitude protection
- Choice of Gauge
- Asset Maintenance
- Platform

(18 marks)

b) Explain how semaphore signals work.

(7 marks)

SECTION B

QUESTION 5

- a) You have been given the task of choosing a site for an aerodrome in Mutorashanga. Describe four factors that you would consider when choosing a site for the aerodrome.

(4 marks)

- b) Determine the crosswind component and the headwind component for a wind speed of 20 knots when the angle between the runway and direction of wind is 60° . Use neat sketches to illustrate your solution.

(10 marks)

- c) What is a crosswind runway and under what circumstances would a crosswind runway be provided?

(3 marks)

- d) Show the runway designation markings for two parallel east-west runways. Use neat sketches to illustrate your answer.

(8 marks)

QUESTION 6

- a) With the aid of a neat sketch describe the wind rose diagram and explain its function in the design of an aerodrome.

(10 marks)

- b) Explain the following aerodrome terms with the aid of neat sketches where possible

- i. Taxiway
- ii. Taxilane
- iii. Blast pad
- iv. Apron
- v. Shoulder

(10 marks)

- c) Lighting, marking and signage are visual aids that assist the pilot on approach to an airport, as well as navigating around an airfield and are important elements of airport infrastructure. List five specific lighting systems that should be provided at an airfield.

(5 marks)

QUESTION 7

a) You have been given the task of developing Aerodrome Pavement Maintenance and Inspection Procedures for Joshua Mqabuko Nkomo International Airport. Explain the information would you include in your Aerodrome Maintenance and Inspection Procedures including details of what the aerodrome inspections should address.

(20 marks)

b) Explain the use and purpose of a NOTAM.

(5 marks)

THE END