



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

TRANSPORTATION ENGINEERING & PLANNING II

TCW 3202

Main Examination Paper

MAY 2015

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

Examiner's Name: Eng. M. Marerwa

INSTRUCTIONS

1. Answer any Four (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
TOTAL	100

SECTION A

QUESTION 1

- a) Draw a fully labelled section the bull head type of rail. **(5 marks)**
- b) Using a fully labelled sketch of a left-handed turnout illustrate (and explain), in turn, the two different pathways that a train travelling in the facing direction could take. **(12 marks)**
- c) The ruling gradient on a track is 1 in 250 on a curve of 4 degrees. Calculate the grade compensation and the required (actual) ruling gradient. (Use a rate of 0.04 per degree for grade compensation). Explain why grade compensation is necessary **(8 marks)**

QUESTION 2

- i) Detail at least 5 specific functions of an NRZ Materials Yard. **(10 marks)**
- ii) Briefly describe the duties of an NRZ Permanent Way Inspector (PWI) **(4 marks)**
- iii) With the aid of sketches explain the circumstances under which the following are used
- a) Standard fishplate
 - b) Joggled fishplate
 - c) Junction fishplate **(6 marks)**
- iv) Sketch out a ladder track and explain its location and function. **(5 marks)**

QUESTION 3

- a) Utilising sketches illustrating at least 3 different phases or scenarios, explain how semaphore signals safely control the movement of rail traffic. Include the expected reactions of train drivers in each scenario. **(12 marks)**
- b) High speed passenger trains can reach in excess of 300km/h therefore making it difficult for train drivers to interpret mounted signals at such high speeds.
- i) Explain what the acronym SPAD stands for in railway signalling? **(2 marks)**
- ii) Name and describe in detail an applicable method of signalling that eliminates signalling failure due to human factors in such instances. **(8 marks)**
- iii) Token block is another form of signalling. What would be its limitations in high speed track signalling? **(3 marks)**

Question 4

Calculate the following elements required to set out a 1 in 10 turnout taking off from a Medium Gauge (MG) track from the toe of the switch and tangential to the gauge face and passing through the Theoretical Nose of Crossing (TNC): (express your answers in mm)

- Curve Lead (CL)
- Outer Radius (R_o)
- Radius of turnout (R)
- Switch Lead (SL)

Data: $CL = 2GN$

$N = \cot \phi$

$MG = 1.097m$

The Heel Divergence (d) = 11.4cm

(25 marks)