

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT OF CIVIL AND WATER ENGINEERING  
FACULTY OF INDUSTRIAL TECHNOLOGY  
BACHELOR OF ENGINEERING (HONOURS) DEGREE  
PART III SECOND SEMESTER EXAMINATION-MAY 2011  
TRANSPORTATION ENGINEERING & PLANNING II – TCW 3202**

**INSTRUCTIONS**

Answer any four questions.

Time : 3 hours  
Total Marks: 100

Candidates to attempt at least one question from **Section B**

**SECTION A**

**QUESTION 1**

- (a) i) List the two most common types of line side signals **(2 marks)**
- ii) Define a Signalling System and differentiate between a “System” and a Line side signal **(4 marks)**
- (b) Describe a semaphore Distant Signal and state:
- i) Its positioning relative to the Stop Signal
- ii) The expected reaction from the driver when the signal is ‘on’ **(2 marks)**
- (c) i) Explain with the aid of sketches how a train is detected in Track Circuit Block Signalling. **(5 marks)**
- ii) Explain the effects of the following on a line with Track Circuit Block Signalling:
- leaves
  - steel tape measure **(2 marks)**
- iii) What signaling measures can be taken to maximize track capacity in a safe manner. **(5 marks)**
- iv) Explain the acronym SPAD. Give an example of a fail safe method of safety used in signaling and explain how it works **(5 marks)**

## **QUESTION 2**

- i) With the aid of a sketch, briefly explain how you would attach a typical rail onto a concrete sleeper at a straight and level section, define any fixtures and fastenings you will make use of. **(5 marks)**
- ii) Draw a fully labeled cross-section of the permanent way and explain the functions of each element. **(10 marks)**
- iii) Explain the location and function of catch pits in track side drainage **(2 marks)**
- iv) Define the 3 common types of sleepers and expand on the advantages and disadvantages each. **(8 marks)**

## **QUESTION 3**

- (a) List the advantages and disadvantages of railway transportation relative to road transportation. **(8 marks)**
- (b) You are tasked with reviewing the NRZ's operational model with a view to increasing efficiency through refocusing and restricting the parastatal to certain core activities. Explain and justify the new model you would put forward, discussing the following in particular:
  - the permanent way
  - railway stations
  - rolling stock
  - how charges are effected
  - punitive charges or fines

Back up your proposal by citing successful similar models elsewhere in the world as well as comparing with toll taking on national roads. **(10 marks)**

- (c) Define the following:
  - i) Switch
  - ii) Guard or Check rail
  - iii) Turnout
  - iv) Grade Compensation **(4 marks)**
- (d) List the appropriate Personal Protective wear that a typical railway operative needs to use to allow safe working **(3 marks)**

#### **QUESTION 4**

- i) Write brief notes on platform design expanding on the following:
- platform height
  - track alignment at stations
  - centre throw and end throw
  - measures to increase user safety
  - buffer stops including risk zones
- (4 marks)**
- ii) Differentiate between renewal and maintenance of the track. Explain what activities are involved in each. **(5 marks)**
- iii) Define 2 different types of track defects and explain the likely consequences of not addressing them. **(4 marks)**
- iv) Calculate the following elements required to set out a 1 in 8.5 turnout taking off from a Broad Gauge tracking from the toe of switch and tangential to the gauge face and passing through the Theoretical Nose of Crossing (TNC).
- CL
  - $R_0$
  - R
  - SL
  - L
- (10 marks)**

**Data:** CL = 2GN  
N = cot  $\emptyset$   
Broad Gauge = 1.676m

## **SECTION B**

### **QUESTION 5**

- (a) Explain five factors that should be considered when choosing a site for an airport. **(5 marks)**
- (b) Explain five data required in the selection of a site for an airport. **(5 marks)**
- (c) i) What does the term 'runway configuration' refer to? **(1 mark)**  
ii) List the four basic runway configurations **(4 marks)**
- (d) With the aid of a neat sketch describe the wind rose diagram and explain its function in the design of runways. **(10 marks)**

### **QUESTION 6**

- (a) Describe the following in relation to airfields with the aid of neat sketches where possible.
- i) Taxiway
  - ii) Blast pad
  - iii) Runway object-free area
  - iv) Apron
  - v) Shoulder **(5 marks)**
- (b) Describe the crosswind components and the headwind components for a wind speed of 20 knots when the angle between the runway and direction of wind is  $60^{\circ}$ . Use neat sketches to illustrate your solution. **(10 marks)**
- (c) Describe the lighting and markings used on a runway highlighting how each contributes to the safe use of the facility. **(10 marks)**