VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test – II

Programme Name & Branch: B.Tech Civil Engineering

Course Name & Code: CLE 2005 Transportation Engineering

Class Number: VL2019201003762 **Slot:** D1 **Exam Duration:** 90min. **Maximum Marks:** 50

General instruction(s): Answer all questions.

1. Answer the following questions

a Describe the method used by the engineer to obtain density of subbase layer in the field during our field visit. Use diagrams and show the principle using example. (6 marks)

b Draw the three layer system used in pavement analysis and show the two types of strains that are considered in flexible pavement design. (4 marks)

c Write how the coning of train wheels helps the movement of train in straight and curved paths. Show diagram. (4 marks)

2. Axle load survey is used to estimate vehicle damage factor (VDF) on a road. The aim of the survey is to estimate the axle equivalency factor which helps us to convert any axle type into standard axle.

A standard axle is a "single axle with dual tyres (⊟⊟)" with 8160kg load or 80kN weight. For a single axle with dual tyres with a load of L kg, the equivalency factor is $(L/8160)^4$

In an axle load survey, Table 1 shows the number of single axles with dual tyres in five load groups. Calculate the average axle equivalency factor. (8 marks)

Table 1

Load (kg)	3000	6000	9000	12000	15000
No. of axles	15	23	32	20	10

3. Flexible pavement for a four-lane divided state highway is to be designed with the following data:

Year of opening for traffic: 2022; Design life: 12 years; AADT in 2019 is 40,000. % of commercial vehicles: 6%; Compounded annual growth rate: 5%; CBR of subgrade soil: 8%; Vehicle damage factor: 2.8.

Find the pavement layers and their thicknesses form IRC charts and draw the pavement cross-section diagram (full width upto end of subgrade). Charts from IRC 37:2012 are given in Appendix. (10 marks)

4. An BG track section is going through a 3 degree curve. It has a maximum sanctioned speed of 100 km/hr. Booked speed of the goods train to be 60km/h. (12 marks)

a) Design the superelevation for this curve.
b) Identify the equilibrium speed corresponding to the superelevation provided and the maximum permissible speed.
c) Calculate the transition length to be provided.

5. A 7 degree curve branches off from a 5 degree main line curve in an opposite direction in the layout of a metre gauge yard. If the speed restriction on main line is 60 km/h, calculate the superelevation to be provided on the main line. Calculate the maximum permissible speed on the branch line at the point of divergence.(6 marks)

Appendix