FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL

Course Title: Highway Engineering I **Course Code:** CVE 512
Session: 2018/19 **Semester:** Second **Level:** 500
Instructions: Attempt Four Questions, **Time:** 2 hrs 30 mins

Question 1 (15 marks)

a. What do you understand by the term highway alignment and what its design primarily depends on? What do you do to avoid sudden changes and achieve compatibility in the vertical and horizontal layout of the highway? **5 marks**

b. Highway design is based on specified design standards and controls. Enumerate ten factors on which the roadway system depends. **10 marks**

Question 2 (15 marks)

a. The general form of the parabolic equation, as applied to vertical curve is given as:

$y = ax^2 + \text{bx} + \text{c}$

where:

y is roadway elevation at distance x from the beginning of the vertical curve (the PVC) in m

x is distance from the beginning of the vertical curve in stations or m

a, b are coefficients, and c is elevation of the PVC in m

With a suitable schematic diagram, show that:

$$a = \frac{G2 - G1}{2L}$$

Given that G_2 and G_1 are the gradient or slope of the curve. **5 marks**

b. An equal-tangent vertical curve is to be constructed between grades of -2.0% (initial) and + 1.0 % (final). The PVI is at station 3 + 350.000 and at elevation 130m. Due to a street crossing the roadway, the elevation of the roadway at station 3 + 415.000 must be at 131m. Design the curve **10 marks**

Question 3 (15 marks)

a. What do you understand by Traffic flow theory? **5 marks**

b. With a suitable schematic diagram and the theory postulated with respect to the shape of the curve depicting the relationship between the elements, explain the fundamental diagrams of traffic flow. **10 marks**

Question 4 (15 marks)

a. i. Define the term "Design Speed". **2.5 marks**

ii. Briefly explain what you understand by an appropriate level of safety on highway. **2.5 marks**

b. Draw a suitable schematic diagram for the case of designing a crest vertical curve for adequate stopping sight distance. **4 marks**

c. What is the critical concern for sag vertical curve design? Illustrate the sag vertical curve sight distance design problem with a neat sketch. **6 marks**

Question 5 (15 marks)

a. Traffic signals are needed for the control of conflicting streams of vehicular and pedestrian traffic at intersections. State the warrants defining the minimum conditions under which the installation of traffic signals becomes justifiable. **4 marks**

b. State the advantages and disadvantages of traffic signal. **11 marks**

Question 6 (15 marks)

a. Explain the following:

i. On-Street Parking Facilities **2marks**

ii. Off-street parking **2 marks**

b. i. Briefly discuss two methods by which parking study can be carried out. **6 marks**

ii. Why is the parking usage study conducted? **1 mark**