University Of Technology
Building and Construction Eng. Dept.
Final Exam – First Attempt – 2010/2011
Subject: **Highway Design**   Class: **3rd**
Branch: **Highway and Bridges Eng. Branch**   Time : **3 Hours**
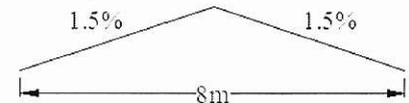Examiner: **Ali M. K.**   Date : **13/6/2011**

Note: Attempt four questions only including question (1)

Q1: Determine the elevations of CL, Right edge, and Left edge of a carriageway from Station (32+40) to Station (34+50) every 10m and at the control points (T.S, S.C) if you know that:
- Length of transition spiral curve = 150m.
- Superelevation rate = 5%
- Cross section of the carriageway is:
- Station of T.S = 32+95 and its elevation = 40m.
- The roadway has an adjacent grade of -2% from station 30+00 to station 32+00, and a grade of -1% from station 32+00 to station 33+00, and a grade of +1% from station 33+00 to station 35+00 without using a vertical curve.
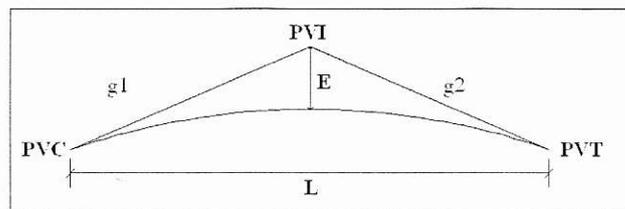- The rotation of the roadway is about centerline.
- Use **three** digits of precision for elevation values, e.g. (**40.000**).   **(25 marks)**

Q2: (a) For the symmetrical vertical curve shown below, prove that E=(A*L/8).   **(15 marks)**

(b) A simple circular curve has a length of 122m with 119m chord length. Determine all elements of this curve.   **(10 marks)**

Q3: A compound horizontal curve having the following data: R1=400, R2=600m, $\Delta1=10°$, $\Delta2=15°$, Station of PI=70+00. Calculate the total deflection angle every 10m along this curve.   **(25 marks)**

Q4: For an earthwork construction of a highway section, the following data has been obtained:

Station	0	4	7	11	13	16	20
Cum. Vol. (m³)	0	-400	-500	+300	+300	-100	-500

Assuming that the cost of overhaul = 1000 ID/m³.station, cost of borrow = 5000 ID/m³, freehaul distance = 300m. Draw MHD and the longitudinal profile of the highway and find the following: **(25 marks)**
(a) Freehaul volume, (b) Overhaul volume, (c) Waste volume, (d) Borrow volume,
(e) Limit of Economic Haul.

Q5: According to the Iraqi Highway Design Manual: **(25 marks)**
   a- What are the types of pavement markings? Draw two types with dimensions. **(6 marks)**
   b- What are the locations of using the warning traffic signs? Draw three warning signs and write the color of each sign part on the drawings. **(6 marks)**
   c- Draw the fill side slopes of an embankment below a roadway if you know that the difference between them is 9m. **(7 marks)**
   d- What are the locations of installing guardrails? **(6 marks)**

Good Luck…