THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY (CIVIL) - LEVEL 4
FINAL EXAMINATION - 2005/2006

CEX 4236 - HIGHWAY ENGINEERING

Time allowed : Three hours

Date : Monday, 24th April 2006 **Time : 9:30 - 12:30**

Answer any five questions. All questions carry equal marks. Write down your Index Number clearly on the answer script.

(01)

Describe the following (with sketches where necessary)

(a). 'Enoscope method' for measuring spot speeds. (5 marks)

(b). Tidal flow (reversible lanes). (5 marks)

(c). Passing sight distance. (5 marks)

(d). Three types of "peripheral car park developments" available in developed countries (5 marks)

(02)

(a). Draw a neat cross-section of a four-lane, two-way road with a centre median running along a cut and fill section, clearly indicating and labelling all the important elements. (8 marks)

(b). Write down the expected functions of a median. (4 marks)

(c). Write down the functions of a shoulder. (4 marks)

(d). When a carriageway is to be widened on a curve, what are the four main considerations to be taken in to account? (4 marks)

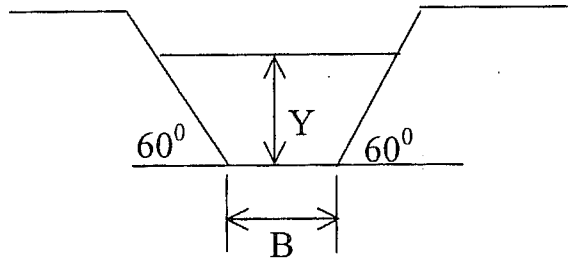
(03)

In designing an appropriate drainage system, the most important design considerations are hydrologic and hydraulic. Discuss the elements to consider under each of these. (5 marks)

One of the major causes of road failure is its improper drainage. List out the ways in which improper drainage can cause destruction. (5 marks)

In a road-side open drain, water flows at uniform depth along a trapezoidal section as shown below. Channel slope, s = 0.001. The appropriate value of Manning's n = 0.014 and the side slope angle is 60^0.

Given the bottom width B = 1.2 m, and the depth of flow Y = 0.1 m, find the velocity V and the discharge Q. (10 marks)



(04)

(a). When a major road intersects a minor road, the safety at the intersection may be improved by staggering the minor approaches of the intersection to form two T-junctions.

Explain in brief:

1. The conditions of application for above treatment. (4 marks)
2. Advantages of above treatment. (3 marks)
3. Disadvantages of above treatment. (3 marks)

(b). When two local roads intersect, the operation of the intersection may be improved by introduction of a small roundabout.

Explain in brief:

1. The conditions of applications for above treatment. (4 marks)
2. Advantages of above treatment. (3 marks)
3. Disadvantages of above treatment. (3 marks)

(05)

Bitumen is one of the main materials used in highway pavement construction, and also we know that the origin of highway bitumen is either 'natural asphalt' or 'crude petroleum'.

(a). Discuss the different types of 'natural asphalt' bitumen. (8 marks)

(b). Describe 'crude petroleum' based bitumen in short. Draw the schematic diagram showing components of asphaltic base petroleum crude oil indicating the components in order of decreasing volatility. (12 marks)

(06)

State any conditions to be satisfied by the length of road selected, and the rules to be observed by the driver of the moving vehicle and the observer in the moving vehicle method of finding average journey speed. (4 marks)

During a moving vehicle method survey six runs were made in each direction along the two-way highway between Nugegoda and Maharagama (assume that the distance between Nugegoda and Maharagama to be 6.5 kms). Flows were measured both with and against the moving vehicle, and the following observations were recorded.

(a). Vehicle traveling from Nugegoda to Maharagama

Trip		Number of vehicles		
Start (mm:sec)	End (mm:sec)	Overtaking the test car	Overtaken by the test car	Met in opposite direction
16:05	16:16	2	1	410
16:34	16:44	3	2	398
17:05	17:17	4	1	402
17:35	17:44	5	3	358
18:05	18:18	2	1	388
18:35	18:45	2	2	406

(b). Vehicle traveling from Maharagama to Nugegoda

Trip		Number of vehicles		
Start (mm:sec)	End (mm:sec)	Overtaking the test car	Overtaken by the test car	Met in opposite direction
16:19	16:31	3	2	330
16:50	17:03	7	0	307
17:20	17:32	4	2	356
17:50	17:59	4	3	348
18:20	18:33	5	2	302
18:50	19:01	7	1	298

If $q = (x + y) / (t_w + t_a)$ and, $t = (t_w - y/q)$, where the terms in the expressions have the usual meanings,

(i). Calculate the average traffic flow in each direction. (8 marks)

(ii). Calculate the average journey speed from Nugegoda to Maharagama and from Maharagama to Nugegoda. (8 marks)

(07)

(a) State the six main types into which soils can be broadly classified. (6 marks)

(b). Briefly discuss the characteristics and quality of these six types of soil. (6 marks)

(c). What are the three types of soil out of those you have stated in (a) above which are suitable for highway engineering? What types of soil pose practical problems in highway engineering? (8 marks)

(08)

(a). During an off-road parking supply survey, gathering information on 'off-road space inventory' is an important component. List and briefly explain the items that will be collected under this component. (6 marks)

(b). Explain what is meant by a 'parking duration survey' and make clear how the 'concentration surveys' are combined with it. (4 marks)

(c). What are the main objectives of a 'time limit parking scheme'? (4 marks)

(d). Describe the following types of 'time limit parking management techniques'.

(I). Traffic warden controlled
(II). Parking meter controlled
(III). Parking discs (or labels)

(6 marks)