

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Civil Engineering

049



Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: CVX7345 Bridge Engineering & Design
Academic Year	: 2022/2023
Date	: 5 th February 2024
Time	: 0930-1230hrs
Duration	: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **Eight (8)** questions in **Three (3)** pages.
 3. Answer any **Five (5)** questions only. All questions carry equal marks.
 4. Answer for each question should commence from a new page.
 5. This is a Closed Book Test (CBT).
 6. Answers should be in clear hand writing.
 7. Do not use Red colour pen.
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Q1.

- (a) In Sri Lanka there are several agencies in charge of roads. According to guide to the classification of roads by the Road Development Authority, roads are classified into 5 classes (Class A, Class B, Class C, Class D and Class E). Briefly describe about these road classes. (05 marks)
- (b) Briefly describe the procedure in planning a road system. (05 marks)
- (c) Briefly describe two main traffic flows namely; Un-interrupted Traffic Flow and Interrupted Traffic Flow (05 marks)
- (d) Briefly describe these terms in your words; Peak Hour Traffic Volume (PHV), Running Speed, Time Headway (05 marks)

Q2.

- (a) When planning a road network for a particular area, there are several road patterns or layouts that may be used as guidelines. With the help of neat diagrams indicate three such patterns that could be used to fit a road network in a region under consideration. (07 marks)
- (b) Write down the expected functions of a Centre Median (04 marks)
- (c) Write down the functions of a Road Shoulder (04 marks)
- (d) When a carriageway is to be widened on a curve, what are the four main considerations to be taken in to account? (05 marks)

Q3.

- (a) In a traffic stream, the clear spacing between any two adjacent vehicles is 30 metres and the length of each vehicle is 6 metres. The speed measurements made at a particular instant of time gave the following vehicle speeds: 5 vehicles at 40 km/hr, 20 vehicles at 45 km/hr, 3 vehicles at 50 km/hr. For this stream of vehicles, find (a) density, (b) space mean speed, and (c) traffic volume. (08 marks)
- (b) Explain what is meant by a 'Parking duration survey' and make clear how the 'concentration surveys' are combined with it. (04 marks)
- (c) What are the main objectives of a 'time limit parking management scheme'? (04 marks)
- (d) Describe the following types of time limit parking techniques;
 - (i) Traffic warden controlled,
 - (ii) Parking meter controlled (04 marks)

Q4.

- (a) The ability of the drivers to see the road ahead is probably the most important feature in the safe and efficient operation of a road. Briefly describe 'Stopping Site Distance (SSD)' and 'Passing Site Distance (PSD)' in your words
(05 marks)
- (b) Neatly sketch forces acting on a vehicle moving about a horizontal curve with a super-elevated surface
(05 marks)
- (c) Horizontal curvature design is a very important feature in the safe and efficient movement of vehicles on a road. Show the basic properties of a simple highway curve in a neat sketch.
(05 marks)
- (d) Draw a typical cross section of a four-lane undivided road naming important elements and indicating rough dimensions.
(05 marks)

Q5.

- (a) Draw neat sketches of Restrictive signs, Prohibitory signs, Mandatory signs, Priority signs, Direction signs (One from each type).
(05 marks)
- (b) What are the important features that have to be looked into during a road safety audit.
(05 marks)
- (c) Briefly describe standard plans used for road design namely View plan, Longitudinal section, Cross-sections and Haulage diagram. (05 marks)
- (d) Convex vertical curves are known as crest curves. Illustrate line of sight at crest in a neat sketch.
(05 marks)

Q6.

- (a) Distinguish between 'bitumen emulsions' and 'cut-back bitumen'.
(06 marks)
- (b) Explain briefly the softening test carried out to evaluate the consistency of bitumen, indicating the type of apparatus used in the laboratory.
(07 marks)
- (c) Explain the three different types of structural failures that can be observed in highway pavements, explaining what happens under each type of failure.
(07 marks)

Q7.

- (a) There are a large number of methods of pavement design now in use. Even-though the existing methods of design are so diverse they can be classified into four distinct groups. List these four groups.
(04 marks)
- (b) Draw a cross-section of a highway flexible pavement indicating the structural components. Discuss the general factors that affect pavement design.
(05 marks)
- (c) Explain the steps involved in carrying out a (i) single Base Surface Treatment (SBST), and (ii) Double Base Surface Treatment (DBST) dressing for a road surfacing process
(06 marks)
- (d) List three different types of applications that are available in modern day road surface construction and discuss for what purposes they can be used.
(05 marks)

Q8.

- (a) Draw a neat diagram of a hydrologic cycle and label all the important features on it. Briefly explain three components that constitute the hydrologic cycle.
(07 marks)
- (b) Various return periods of design storms are usually used to design highway drainage works. Briefly explain different types of drainage works and relevant design periods of design storms.
(05 marks)
- (c) Water flow at uniform depth along a roadside drain of trapezoidal section with a slope of 0.002. The appropriate value of Manning's n is 0.014 and the side slope of the drain is 1:1. Given the bottom width of the trapezoidal section as 1.25m, find the depth of flow for a discharge of $3.2 \text{ m}^3/\text{s}$ in the drain.
(08 marks)