**THE OPEN UNIVERSITY OF SRI LANKA**
**DIPLOMA IN TECHNOLOGY (CIVIL) - LEVEL 4**
**FINAL EXAMINATION - 2011/12**

**CEX4232 - CONSTRUCTION ENGINEERING AND PLANNING**

**Time allowed : Three hours**

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**Date : Wednesday, 29th February 2012** **Time : 09:30 - 12:30**

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Selecting at least two (2) questions from each section, answer a total of five (5) questions. All questions carry equal marks.

Answers for sections A & B should be submitted on separate answer books with Section A and Section B written clearly on the cover of the respective book.

Write down your Index Number clearly on both answer books.

## SECTION A

**(01)**

(a). Explain what is meant by 'soil compaction'. (04 marks)

(b). What are the factors which influence the degree of soil compaction? (04 marks)

(c). Briefly describe the procedure for compacting earthworks. (04 marks)

(d). A layer of topsoil is to be moved over a haul distance of 30 meters with the help of a bulldozer under the following operating conditions:

The bulldozer travels at 3 km/h when it is pushing the topsoil and returns at double the pushing speed. The time taken for loading, shifting gears etc. takes 0.35 minutes for each cycle. The operating factor is 50 minutes per hour. The soil has a swell of 25% and the rated capacity of the machine is 4 cubic meters of loose volume.

Determine the output of the bulldozer per, hour. Indicate each step of your calculations. (08 marks)

**(02)**

(a). Discuss the significance of the water cement ratio by considering *separately*, the effect of water content and the effect of cement content on the strength and workability of concrete. (07 marks)

(b). Explain what is meant by 'segregation' of a concrete mix, its causes and how it affects the concrete cast at site. (06 marks)

(c). Explain what is meant by 'curing' of the concrete cast at site, and the reasons for doing it. (07 marks)

**(03)**

(a) As a responsible engineer the safety of people and property should be ensured when building in densely built-up areas.

i. State six (6) important points to be considered in determining the type and degree of support which should be provided to the sides of an excavation.
(06 marks)

ii. Discuss two (2) important factors to be considered before commencing excavations very close to existing buildings. (05 marks)

(b) Explain using clear, neat sketches, the use of a profile board to set out excavations for foundations of a new building.
(04 marks)

(c) Write short descriptive notes on "displacement piles" and methods of installing them.
(05 marks)

**(04)**

Describe the following using illustrations where relevant.

(a) The ventilation of drains with emphasize on giving reasons for ventilation of drains, and method of providing it.
(05 marks)

(b) The function and locating of manholes.
(05 marks)

(c) Selection of pipe gradients for a drainage system.
(05 marks)

(d) The testing procedure of internal soil pipes.
(05 marks)

## SECTION B

**(05)**

(a) What do you understand by 'Construction Planning' ?
It is required to construct a water supply scheme for a university having 10,000 residential students. Explain the complete construction planning process describing the different levels of planning which are relevant to this project.
(12 marks)

(b) Describe 'Unsafe Acts' and 'Unsafe Conditions' with reference to construction sites.
Outline four important accident prevention measures that can be taken at the planning stage of a construction project. (08 marks)

**(06)**

(a) Explain what is meant by 'Unit Rate Estimating' (02 marks)

(b) Prepare a 'Direct Cost Estimate' for the following BOQ item.

1:3:6 (20mm) cement concrete in column shaft

Calculate the rate of the above item using 'Unit Rate Estimating', using the following data:
Make necessary assumptions. (06 marks)

Data

| | | | |
|---|---|---|---|
| Cement : | Weight of a bag of cement | = | 50kg |
| | Bulk density in bag form | = | 1442kg/m$^3$ |
| Sand : | Bulk density | = | 1600kg/m$^3$ |
| Metal-20mm : | bulk density | = | 1440kg/m$^3$ |
| Specific gravity of cement | | = | 3.1 |
| Specific gravity of sand | | = | 2.65 |
| Specific gravity of metal 20mm | | = | 2.80 |
| Water : density | | = | 1000kg/m$^3$ |
| Water Cement ratio (by weight): | | = | 0.52 |
| Wastage: | Allow 6% for all the materials | | |
| Mark-up: | 25% | | |

Labour norms:

| Description | Man hours | |
|---|---|---|
| | Mason hrs | Unskilled labour hrs |
| 1:3:6 (20mm) concrete per m$^3$ (manual mixing& supply) | 3.5 | 28.00 |

Cost Data:

| | |
|---|---|
| Cement | - Rs 750/ bag |
| Sand | - Rs 2400/m$^3$ |
| Metal(20mm) | - Rs 1800/m$^3$ |

Water - Free
Mason (8 hours day) - Rs 800/day
Unskilled labour (8 hrs day) - Rs 600/day

(c) Explain a better and more accurate method of arriving at a direct cost estimate for the same item of work considering the 'operations' involved.

(08 marks)

(d) What are the items of data to be stored in a Cost Data Bank for estimating building costs?

(04 marks)

(07)

(a) The following schedule of activities refer to a concreting process.

| Activity | Description | Duration (weeks) | Resources (men) |
|---|---|---|---|
| 1-2 | Excavate foundations and basement-stage 1 | 2 | 2 |
| 2-3 | Excavate foundations and basement-stage 2 | 6 | 4 |
| 2-4 | Concrete foundations-stage 1 | 3 | 3 |
| 3-5 | Water proof lining to basement | 6 | 3 |
| 3-4 | Break out old sub-structure | 1 | 1 |
| 4-5 | Concrete foundations-stage 2 | 3 | 3 |
| 5-6 | Concrete basement walls | 2 | 2 |

(i) Draw an activity-on-arrow network showing durations, event numbers and event times
(ii) Prepare a list of activities for the above project, ranked in the order of their earliest start dates and latest start dates. Indicate the total float of each activity
(iii) Draw a Bar Chart for the project showing event times
(iv) Prepare resource aggregation charts based on the above list of activities in earliest and latest start order.

(12 marks)

(b) Outline the steps in 'smoothening of resources' for the above project and carry out resource smoothening. Decide on the optimum resources required.

(08 marks)

(08)

(a) Explain the different types of concrete distribution plants with the help of neat sketches.

(08 marks)

(b) Describe the most commonly used techniques of 'progress control'. Explain with the aid of diagrams how such techniques can be used effectively in a construction site to monitor progress.

(12 marks)