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**THE OPEN UNIVERSITY OF SRI LANKA**
**DIPLOMA IN TECHNOLOGY (CIVIL) - LEVEL 4**
**FINAL EXAMINATION - 2009/10**

**CEX 4232 - CONSTRUCTION ENGINEERING AND PLANNING**

**Time allowed : Three hours**

**Date : Wednesday, 10th March 2010** **Time : 09:30 - 12:30**

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)**

The quality of workmanship is important to ensure the strength and durability of concrete. Discuss the following in relation to this statement.

(a). List and explain the precautions you would take when compacting concrete using an internal vibrator. (04 marks)

(b). Explain what is meant by 'entrapped air' and 'entrained air' (04 marks)

(c). Explain about construction joints and their suitable locations. (06 marks)

(d). Explain the importance of curing of concrete, why we do it, and how we do it at the site. (06 marks)

**(02)**

Supply of water, proper drainage, and waste disposal are three (3) important services that a building should consist of when design a properly functioning building.

(a). All soil, waste and vent pipes above ground must be tested according to the requirements of the local authority. Describe the relevant testing procedure using a neatly drawn diagram. (05 marks)

(b). The drainage system for a home can be either 'combined' or a 'self-separate' system. Provide a neat sketch for a typical self-separate drain system. (05 marks)

(c). Sketch the plan and the cross-section of a typical septic tank and briefly explain the treatment process which takes place in the septic tank. (05 marks)

(d). Explain with a sketch why the volume of water drained from a pitched roof is greater when there is a strong wind during a rain. (05 marks)

**(03)**

(a). Draw a neat sketch of a flexible road pavement indicating the different layers. Briefly describe each of the above layers. (05 marks)

(b). Explain how the compaction of a sub-base is carried out while describing the movement of rollers that are used. (04 marks)

(c). Tar, Bitumen and Asphalt are <u>three</u> (3) terms often used in relation to wearing surfaces. Briefly explain these 3 terms. (06 marks)

(d). Write down <u>five</u> (5) main functions that are expected of a road surfacing. (05 marks)

**(04)**

(a). When using dump trucks for construction purposes, describe the type of jobs for which the side dump trucks are preferred over rear dump trucks.

If land clearing is to be done with the help of a crawler tractor by fitting various attachments, list <u>four</u> (4) of these attachments that can be used. (04 marks)

(b). 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 2.5 km/h when it is pushing the topsoil and returns at double the pushing speed. The time taken for loading, shifting gears etc. is 0.4 minutes for each cycle. The operating factor is 45 minutes per hour. The soil has a swell of 15% and the rated capacity of the machine is 4 cubic meters of loose volume. Determine the output of the bulldozer per hour. (05 marks)

(c). Name the type of pump that can be recommended for a site where the pump has to be kept inside the liquid to be pumped. With the help of a suitable sketch explain how these pumps are installed. (04 marks)

(d). Although reciprocating pumps are not widely used in construction sites, but for special types of work these pumps are extremely valuable.

Write down <u>three</u> (3) applications of reciprocating pumps.
Write down <u>four</u> (4) disadvantages of reciprocating pumps. (07 marks)

## SECTION B

**(05)**

A suitable housing project is to be planned, designed and completed to settle persons displaced due to demolition of unauthorized houses adjoining the sea in the Dehiwala area. Approximately 100 houses are to be demolished and as a result 500 persons are to be relocated in the Attidiya area.

(a) Discuss the issues to be considered during the 'macro planning' process of this project.

(10 marks)

(b) What are the items to be included in the 'total construction planning' process of this project?

(10 marks)

**(06)**

The following table gives a set of activities taken from a project concerned with construction of a playground. The duration, precedence of each activity and requirement of resource 'R' is given in the table in relation to each activity. Completion of activities D, G and H will end the project.

| Activity | Duration (weeks) | Preceding activity | Requirement of Resource 'R' (per week) |
|---|---|---|---|
| A | 3 | - | 4 |
| B | 1 | - | 5 |
| C | 3 | A | 6 |
| D | 4 | A | 4 |
| E | 4 | B | 5 |
| F | 5 | B | 3 |
| G | 2 | C,E | 3 |
| H | 3 | F | 1 |

(a) Explain the benefits of using Critical Path Method (CPM) as a project monitoring and controlling technique. (04 marks)

(b) Draw the activity on arrow network diagram for the given project and indicate the critical path. Determine and tabulate the early start time (EST), late start time (LST), early finish time (EFT) and late finish time (LFT) for each activity by carrying out the forward and backward passes. Indicate one sample calculation. Determine the Total Float for each activity.

(08 marks)

(c) Draw the histogram for resource 'R' for the above project using early start times (EST). Explain how you perform 'resource smoothening' operation for the weekly requirement of resource 'R'. (08 marks)

**(07)**

A decision has been taken to construct a multi-storey building consisting of 100 luxury apartments on a filled up land in the outskirts of Colombo.

(a) List and describe the site facilities to be provided at this construction site.
(08 marks)

(b) Discuss in detail how you will plan the layout of the site facilities identified in (a) above. You may include a suitable layout plan to illustrate your answer.
(12 marks)

**(08)**

Write short notes on any two of the following.

(a) Factors that will increase the production rate of earthmoving operations

(b) Explain how you can calculate a unit rate for concrete using
(i) 'Unit Rate Estimating' and
(ii) 'Operational Estimating'

(c) Accident prevention measures that can be taken at the planning stage of a construction project

(d) Describe types of open wounds and the first aid for open wounds. Also describe ONE method for each stage of first aid.

(20 marks)