THE OPEN UNIVERSITY OF SRI LANKA
Department Of Civil Engineering
Postgraduate Diploma in Technology - Construction Management - Level 7

CEX7111 – Construction Plant Management & Construction Safety

FINAL EXAMINATION - 2013/2014

Time Allowed: Three Hours

Date: 2014 - 08 – 27 (Wednesday) Time: 0930 - 1230 hrs

Answer Four (04) questions with at least one (01) from Section B.

Section A: Construction Plant Management

Q1.

i.) One of the categories in the classification for construction machinery and equipment by the CIB working Commission on Mechanization in Building is **'Earth Moving Machines & Equipment'**. This category has *nine (09)* sub categories representing various earth handling equipment. Name *six (06)* of these sub categories, with short explanations.

(08 Marks)

ii.) The context of Management can be dealt under four major functions. Name and describe these *four (04)* functions of Management with reference to construction project execution.

(08 Marks)

iii.) Clearly discuss the components of the **Total Time** for a construction equipment with short descriptions of each component. Through this define and discuss the significance of **Operational Availability**, and **Mechanical Availability** with regard to construction operations.

(09 Marks)

Q2.

i.) In detail, describe the **Power Train** of an **Articulated Wheeled Loader** of 2.0 m^3 bucket capacity with **four wheel drive** and **power shift transmission**. In your description pay special attention to **hydraulic power flow** for different actuators of the machine.

(08 Marks)

ii.) Describe *three (03)* main **physical attributes** on which **Motor Graders** can be classified. Discuss alternative features available under each category and the utility of these for different types of construction operations.

(08 Marks)

iii.) Develop an equation for calculating the production rate of a double drum tandem, vibratory compaction Roller. You should use the physical characteristics/dimensions of the machine, number of passes required for desired compaction level, speed of the machine, etc., in the development of this equation.

(09 Marks)

Q3.

i.) A tank bund had breached due to the heavy rains during the past months. The breach is 800 m long and the average height of the breach is 2 m. Crest width of the existing bund is 2 m with sides sloping at 1 : 2 on either side. Reconstruction of the breach has to be completed in two months (50 working days). A contractor who intends to bid for the reconstruction of the breached section of the dam needs to calculate the number of trucks required to haul soil from a remote burrow area and whether the work can be accomplished within the time allocated, based on the following information.

a.) The soil at the burrow area will be loaded by a hydraulic excavator of 2.0 m^3 bucket and a bucket factor of 0.8 for this type of soil. Cycle time for the excavator is 3 minutes.
b.) The haul distance is 4.0 km one way.
c.) The average working day is 10 hrs.
d.) Capacity of each truck is 8 m^3.
e.) Average speeds of truck over haul roads with load, 12 km/hr. & without load, 20 km/hr.
f.) Dumping time and spot times are 4 minutes and 3 minutes respectively.
g.) Compaction factor for the soil is 0.75.

(15 Marks)

ii.) Describe an engine management system (sometimes referred to as engine management computer). Describe the functions expected of such a system and comment on the desirability of having such a system for a loader/backhoe combination commonly used in Sri Lanka.

(10 Marks)

Q4.

i.) Develop an argument supporting the statement that "Most realistic method to depreciate construction plant is the straight line method", in comparison with the other *two (02)* common ways of quantifying depreciation.

(10 Marks)

ii.) A contractor wishes to compare the average hourly **owning and operating costs** of a Bulldozer he wishes to purchase, with that of existing machine hire rate. He plans to finance his purchase by a bank loan. Since his intended lifespan for the machine is 5 years, he needs the average hourly **owning and operating cost** during the third (03) year of service of the machine. Evaluate this value based on the following data.

The engine is a 200 hp turbocharged Diesel (Gross power). You may assume any other factors not provided.

Purchase price	-	Rs. 4,000,000/= (Reconditioned)
Interest on capital	-	12 % per annum
Annual usage	-	3,000 Hours
Useful lifetime	-	15,000 Hours
Scrap value	-	Rs. 1,000,000/=
Registration fee	-	Rs. 6,000/= per annum
Insurance premium	-	1.5 % of the value at the year beginning
Depreciation method	-	Straight Line

Specific fuel consumption	-	0.16 kg/HP/Hour
Specific gravity of diesel fuel	-	0.80
Diesel fuel cost	-	Rs. 120/= per liter
Average engine load factor	-	75 %
Average lubricant/filter change interval	-	300 Hours
Total lubricant capacity	-	25 liters
Average lubricant cost	-	Rs. 360/= per liter
Number of filters to be changed	-	3 per interval
Average cost of a filter	-	Rs. 1,800/=
Annual Maintenance/Repair cost (Assumed uniform over the lifespan)	-	100 % of annual depreciation
Operator wages	-	Rs. 300/= per hour

(15 Marks)

Section B Construction Safety and First Aid

Q5.

i.) Discuss *five (05)* **accident prevention measures** that should be considered at the Planning stage of a Construction Project with emphasis on the conditions prevailing in Sri Lankan construction sites.

(08 Marks)

ii.) Construction site safety is an area which may have a significant influence by the psychological outlook of the participating parties. Present your opinion on the **mental attitudes** of workers and management, which resulted in poor safety standards at construction sites in Sri Lanka, several years ago and the positive trends (if any) that has affected the sector through the current construction boom.

(08 Marks)

iii.) Even though several amendments and updradings had been affected the general opinion is that the legal framework pertaining to welfare and safety of the work force is not reflecting the universally accepted standards of the times. What are the basic drawbacks in the presently enforced Safety and Health Legislation in relation to the globally prevailing socio/economic perspective?

(09 Marks)

Q6.

i.) One of the common result of site accidents is personal injury in the form of wounds Name and clearly describe the *five (05)* common types of **wounds** that can be inflicted on a person involved in construction site activities.

(08 Marks)

ii.) Define the medical condition known as 'shock' and enumerate *five (05)* signs of shock that a victim might exhibit. Further, briefly describe first aid measures to be administered to a victim of shock.

(08 Marks)

iii.) A Worker at a construction site where you are the Resident Engineer, has suddenly fallen and is unconscious. The symptoms displayed by the casualty were reported to you as follows, by a Technical Officer.

a.) Foaming at the mouth
b.) Interfered breathing, rigidity and jerky movements of the body occurring alternatively.
c.) Later, gradual subsidence of jerky movements has been observed.

Diagnose the probable medical condition afflicting the victim and propose major first aid and other life saving steps you should follow.

(09 Marks)