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

00037

CEX7111 – Construction Plant Management & Construction Safety

FINAL EXAMINATION - 2011/2012

Time Allowed: Three Hours

Date: 2012 - 03 – 14 (Wednesday) Time: 1400 - 1700 hrs

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

Section A: Construction Plant Management

Q1.

i.) 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)*

ii.) The total time of a construction equipment deployed in the field can be subdivided to various components based on the state of the equipment. Enumerate the applicable time components, which make up the total time, for a construction equipment with short descriptions of each component. Through the above descriptions define and discuss the difference between **Operational Availability**, and **Mechanical Availability** of a construction equipment. *(08 Marks)*

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

Q2.

i.) Describe the **Power Train** of an **Articulated Wheeled Loader** of 1.5 m^3 bucket capacity (as an indication of the size of the machine) with **four wheel drive.** The prime mover for the machine is a **turbo charged & intercooled diesel engine** and **power shift transmission** is employed for traction drive. In your description pay special attention to **hydraulic power flow** for different actuators of the machine. *(08 Marks)*

ii.) Motor graders are very versatile and adaptive machines available for construction operations. Describe *three (03)* main **physical attributes** on which **Motor Graders** can be classified, with alternative features available under each category and the utility of these features in different types of construction operations. *(08 Marks)*

iii.) Develop an equation for calculating the production rate of a articulated wheeled loader serving a truck from a stockpile using V shape loading. You should use the physical characteristics/dimensions of the machine, positioning/changing times, speed of the machine, etc., to develop this equation. *(09 Marks)*

Q3.

i.) A bulldozer based on a Caterpillar, type D6D tractor fitted with a straight type dozer blade (width 3200 mm, height 1130 mm), is utilized in a new road construction project. The D6D tractor is incorporated with power shift transmission for traction. This machine is used to spread medium coarse gravel before roller compaction, for the formation of the sub-base of the road trace. Gravel is transported and dumped at the site by dump trucks. The average spread distance is 50 m under an average drawbar pull of 6000 kg and reversing under no load. Forward speed of the dozer (@ 6000kg drawbar pull in 2 gear) is 4 km/h & Reverse speed of the dozer (at no load, in third gear) is 10 km/h. You may assume, blade factor to be 0.85 and job efficiency factor based on site conditions and operator skill to be 0.80. Compute the production of the machine in m^3/hour. *(15 Marks)*

ii.) Variable displacement hydraulic pumps coupled with mechatronics (or electronic control for mechanical systems) are common in recent construction plant for efficient and economical operations. Clearly describe the advantages of a variable displacement hydraulic pump as compared to constant displacement pumps of older design. *(10 Marks)*

Q4.

i.) Discuss the physical meaning of 'Depreciation' and explain *three (03)* ways of quantifying depreciation of plant, identifying the more suitable method to represent the depreciation of construction equipment. *(05 Marks)*

ii.) Why is the 'interest on capital' considered as an owning cost when economics of a construction plant is evaluated. *(05 Marks)*

iii.) Evaluate the **average hourly owning and operating costs** during the *third (03)* year of service for a Hydraulic Excavator with a diesel power plant of 150 kW power rating.

Purchase price	-	Rs. 12,000,000/=
Interest on capital	-	15 % per annum
Annual usage	-	3,000 Hours
Depreciation method	-	Declining balance method [Remaining Value = $C(1-r)^y$]
Rate of depreciation (r)	-	0.3 (30%)
Registration fee	-	Rs. 15,000/= per annum
Insurance premium	-	0.20% of the value of equipment at the year beginning

Specific fuel consumption	-	0.21 kg/kW/Hour
Specific gravity of diesel fuel	-	0.82
Price of diesel fuel	-	Rs. 115/= per liter
Average engine load factor	-	60 %
Average lubricant/filter change interval	-	360 Hours
Total lubricant capacity	-	21 liters
Average lubricant cost	-	Rs. 350/= per liter
Number of filters to be changed	-	3 per lubricant change interval
Average cost of a filter	-	Rs. 1800/=
Annual Maintenance/Repair cost	-	30 % of annual depreciation
Operator wages	-	Rs. 200/= per hour

(15 Marks)

Section B Construction Safety

Q5.

i.) Name and explain *five (05)* **accident prevention measures** that should be considered at the Planning stage of a Construction Project with particular reference to conditions prevailing in Sri Lanka. *(08 Marks)*

ii.) Psychological outlook of participants in any group activity will have a significant effect on the success or failure of that activity. This hold true also in the case of construction site safety. Compare your opinion on the **mental attitudes** of workers and management, which result in poor safety standards at construction sites in Sri Lanka. *(08 Marks)*

iii.) It is generally understood that the legal framework pertaining to welfare and safety of the work force is not reflecting the needs of the times. What are the basic drawbacks in the Safety and Health Legislation in relation to present socio/economic and work environment? *(09 Marks)*

Q6.

i.) Name and clearly describe the *five (05)* types of **wounds** that can be inflicted on a person involved in construction site activities. *(08 Marks)*

ii.) Describe two (02) situations that could arise at a site due to an accident where a casualty may need the administration of Cardio Pulmonary Resuscitation (CPR). Explain the main steps involved in the administration of this life saving technique. *(08 Marks)*

iii.) A construction site worker has fallen down suddenly and is unconscious. The following symptoms relating to the victim were notified to you by a works supervisor.

a.) Foaming at the mouth

b.) Interfered breathing, rigidity and jerky movements of the body occurring alternatively.

c.) Gradual subsidence of jerky movements.

Diagnose the probable medical condition afflicting the victim and propose major first aid steps to be followed. *(09 Marks)*