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 - 2010/2011

Time Allowed: Three Hours

Date: 2011 - 03 – 23 (Wednesday)   Time: 1400 - 1700 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 Society of Automotive Engineers USA (SAE) has provided with a classification for construction equipment under *six (06)* broad categories. With short explanatory notes, describe *three (03)* of these categories.   *(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.) Scrapers are generally used in projects involving large earthworks, and boulder less soils. Describe *three (03)* major considerations under which Scrapers are classified.   *(08 Marks)*

ii.) Describe the **Power Train** in detail, of an **Articulated Motor Grader** of 2.0 m mould board with **twin tandem driven axels at rear and power shift transmission.** In your description clearly distinguish the **hydraulic power flow and mechanical power flow.**   *(08 Marks)*

iii.) Articulated front-end loaders are popular in quarries where granular material from stockpiles are loaded into transporters. Develop an equation for calculating the production rate of a articulated front-end 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.) 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)*

ii.) A contractor has to bid for a railway embankment construction and he wishes to find the <u>duration for construction of one kilometer length</u> with his available fleet of equipment.

One no. hydraulic excavator with 2.0 m³ of effective bucket capacity & 1.5 minutes cycle time for cutting & loading of the soil.

Six nos. of 10 m³ dump trucks with average speeds of 12 km/hr. with load, & 18 km/hr without load. Dumping time and spot times are 2.5 minutes and 1.5 minutes respectively.

Width of embankment = 6.0 m   Average fill height = 1.5 m   Swell factor for the soil is 1.2

The haul distance is 6.0 km one way.   The average working day is 10 hrs.

                      (15 Marks)

Q4.

i.) Why is the 'interest on capital' considered as an owning cost when economics of a construction plant is evaluated.

(05 Marks)

ii.) Within the three commonly used Comparatively discuss the better method of 'Depreciating' construction equipment among the commonly available methods.

(05 Marks)

iii.) Evaluate the average hourly owning and operating costs during the *third (03)* year of service for a Hydraulic Excavator based on the data given below.

Purchase price	–	Rs. 8,000,000/=
Interest on capital	–	12 % 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. 9,000/= per annum
Insurance premium	–	0.20% of the value of equipment at the year beginning

Power rating of the diesel engine (Gross)	–	125 kW
Specific fuel consumption	–	0.21 kg/kW/Hour
Specific gravity of diesel fuel	–	0.82
Price of diesel fuel	–	Rs. 73/= per liter
Average engine load factor	–	60 %
Average lubricant/filter change interval	–	360 Hours
Total lubricant capacity	–	21 liters
Average lubricant cost	–	Rs. 320/= per liter
Number of filters to be changed	–	3 per lubricant change interval
Average cost of a filter	–	Rs. 1500/=
Annual Maintenance/Repair cost	–	30 % of annual depreciation
Operator wages	–	Rs. 180/= per hour

(15 Marks)

Section B   Construction Safety

Q5.

i.) Write a general explanatory note on construction site accidents clearly indicating direct and indirect costs associated with them. *(08 Marks)*

ii.) Explain the main causes for site accidents with reference to social, attitudinal and economic considerations pertaining to Sri Lankan building construction sites operated by private contractors. *(08 Marks)*

iii.) Discuss the implications of non-compliance with the requirement of insurance for a construction site by the contractor. *(09 Marks)*

Q6.

i.) Identify and clearly explain the importance of first aid in construction sites. Further, describe the necessary facilities and trained personnel needed in a medium scale railway bridge construction site, to provide first aid in the event of an accident perceivable under site conditions. *(08 Marks)*

ii.) Define Shock in an accident victim and enumerate its major signs.

(08 Marks)

iii.) Describe in detail the steps involved in administering Cardio Pulmonary Resuscitation (CPR) on an accident victim. Also state exactly for what medically related condition this technique can be applied. *(09 Marks)*