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 – 2009*

Time Allowed: Three Hours

Date: 2010 – 03 – 24 (Wednesday)

Time: 1400 – 1700 hrs

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

**Section A:** **Construction Plant Management**

**Q1.**

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

*(08 Marks)*

ii.) The Society of Automotive Engineers, USA (SAE) has classified construction equipment under *six (06)* broad categories. Through short explanatory notes, describe *three (03)* of these categories.

*(08 Marks)*

iii.) Describe the components that make up the 'Total Time' for a construction equipment. Further, using these components define **Operational Availability**, and **Mechanical Availability** and discuss their significance with regard to construction operations.

*(09 Marks)*

**Q2.**

i.) Describe the **Traction & Hydraulic Power Trains** of an **Articulated Wheeled Loader** of 2 m³ bucket capacity with **four wheel drive** and **power shift transmission**.

*(08 Marks)*

ii.) Describe *three (03)* main **physical attributes** on which **Motor Graders** can be classified. Further, discuss alternative features available under each category and the utility of these classification in selecting motor graders 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 utilize 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.) One kilometer of road length on a 6.0 m wide road had got washed off due to heavy rains. To rehabilitate the road, average height of fill needed is 1.5 m along its length. The job has to be completed within 20 days. A contractor intending to bid for the job needs to calculate the number of trucks required for the work and whether the work can be accomplished within the time allocated. Following information is provided:
   a.) The loading is to be done by a loader with a 2.5 m³ eff. bucket capacity & a cycle time of 2 minutes.
   b.) Average speeds of truck are, with load, 12 km/hr. & without load, 20 km/hr.
   c.) Dumping time and spot times are 3 minutes and 2 minutes respectively.
   d.) The haul distance is 6.0 km one way.        e.)      The average working day is 10 hrs.
   f.) Capacity of each truck is 10 m³.             g.)      Swell factor for the soil is 1.3.

*(15 Marks)*

ii.) Variable displacement hydraulic pumps coupled with <u>mechatronics</u> (or electronic control for mechanical systems) are common in recent construction equipment. Clearly describe the advantages of a variable displacement hydraulic pump over the constant displacement pumps of older design.

*(10 Marks)*

Q4. A contractor is planning to purchase a **Hydraulic Excavator**, on borrowed capital. He wishes to compare the average hourly **owning and operating cost** of the proposed purchase with market hire rates. For this comparison he needs the average hourly owning and operating cost during the <u>third</u> year of service of the intended machine. Evaluate this value based on the following data:
The engine is a 90 hp turbocharged Diesel (Gross power). You may assume any other factors not provided.

| | | |
|---|---|---|
| Purchase price | - | Rs. 3,000,000/= (Reconditioned Machine) |
| Interest on capital | - | 20 % per annum |
| Annual usage | - | 3,000 Hours |
| Useful lifetime | - | 5 years |
| Scrap value | - | Rs. 1,000,000/= |
| Registration fee | - | Rs. 3,000/= per annum |
| Insurance premium | - | 0.1 % of the value at the beginning of the year |
| Depreciation method | - | Straight line method |

| | | |
|---|---|---|
| Specific fuel consumption | - | 0.16 kg/HP/Hour |
| Specific gravity of diesel fuel | - | 0.80 |
| Average engine load factor | - | 50 % |
| Average lubricant/filter change interval | - | 300 Hours |
| Total lubricant capacity | - | 25 liters |
| Average lubricant cost | - | Rs. 120/= per liter |
| Number of filters to be changed | - | 5 per interval |
| Average cost of a filter | - | Rs. 1,000/= |
| Annual Maintenance/Repair cost | - | 120 % of annual depreciation |
| Operator wages | - | Rs. 100/= per hour |

*(25 Marks)*

## Section B    Construction Safety and First Aid

### Q5.

i.) Psychological outlook of participants in any group activity will have a significant effect on the success or failure of that activity. This holds true in the case of construction site safety, too. Clearly state your opinion on the mental attitudes of workers, which result in poor safety standards at construction sites in Sri Lanka.
*(06 Marks)*

ii.) Name and briefly explain *five (05)* **accident prevention** measures that should be considered at the Planning stage of a Construction Project.
*(06 Marks)*

iii.) State the ways in which responsibility for safety is assigned to parties concerned by the standard conditions of contract used in Sri Lanka.
*(06 Marks)*

iv.) 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 socioeconomic and work environment?
*(07 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.
*(06 Marks)*

ii.) Explain <u>causes, signs and symptoms</u> of Convulsion and describe first aid measures that can be taken.
*(06 Marks)*

iii.) What are the main objectives of first aid in alleviating the condition of a **Burn** victim?
*(06 Marks)*

iv.) When does **Cardio Pulmonary Resuscitation** (CPR) need to be applied to a person? Explain in detail the two main steps involved in administering Cardio Pulmonary Resuscitation.
*(07 Marks)*