



CEX7111 - Construction Plant Management & Construction Safety

FINAL EXAMINATION - 2008

Time Allowed: Three Hours

Date: 2009 - 04 - 06 (Monday)

Time: 0930 - 1230 hrs

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

Section A: Construction Plant Management

Q1.

- i.) The role of Management can be broadly divided into four major functions. Name and describe these *four (04)* functions of Management.
(08 Marks)
- ii.) The classification for construction equipment proposed by the Society of Automotive Engineers USA (SAE) is based on *six (06)* broad categories. Describe with justifications, *four (04)* of these categories, which are more applicable in the context of the Sri Lankan construction industry.
(08 Marks)
- iii.) Identify the various time components that make up the 'total time' of a construction equipment deployed in the field and describe each. Based on these time components define the quantities Operational Availability, Mechanical Availability and discuss the difference between the two for construction equipment.
(09 Marks)

Q2.

- i.) The classification for construction equipment by the Japan Construction Mechanization Association (JCMA) is based on *nine (09)* major categories. With reference to Sri Lankan context describe *four (04)* of these categories.
(08 Marks)
- ii.) For projects involving large earthworks in boulder-less soils, Scrapers are the generally preferred option for earth moving. Describe *three (03)* major considerations under which Scrapers could be classified.
(08 Marks)
- iii.) For an Articulated Motor Grader of 2.0 m mould board propelled by twin tandem driven axels at rear and power shift transmission, describe the different Power Trains clearly distinguishing the hydraulic power flow and mechanical power flow.
(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.) One kilometer of road length has to be constructed as an embankment. Top width of the embankment to accommodate the road is to be 6.0 m with average height of fill for the embankment being 1.5 m. Construction operations have to be completed within 20 days. A contractor who intends to bid for the job has a hydraulic excavator in his inventory but will require to hire dump trucks from an equipment supplier. Therefore he needs to calculate the number of trucks required to carry out the work and whether the work can be accomplished within the time allocated using his excavator only (assume that the compaction of the fill shall be done concurrently by another contractor with adequate compaction equipment). Make your recommendation to the prospective contractor based on the information given below.
- Cutting loading of the soil will be done using a hydraulic excavator with 2.5 m³ of effective bucket capacity and a cycle time of 2 minutes.
 - The haul distance is 6.0 km one way.
 - The average working day is 10 hrs.
 - Capacity of each truck is 10 m³.
 - Average speeds of truck with load, 12 km/hr. & without load, 20 km/hr.
 - Dumping time and spot times are 3 minutes and 2 minutes respectively.
 - Swell factor for the soil is 1.3.

(15 Marks)

Q4.

- i.) Discuss the reason why the 'interest on capital' should be considered as an owning cost when the economics of a construction plant is evaluated.

(05 Marks)

- ii.) 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 Loader Back-hoe combination machine based on the data given below. (You may assume and state any other factors not provided).

Purchase price	-	Rs. 5,000,000/=
Interest on capital	-	15 % per annum
Annual usage	-	3,000 Hours
Useful lifetime	-	18,000 Hours
Depreciation method	-	Declining balance method [Remaining Value = $C(1-r)^y$]
Rate of depreciation (r)	-	0.3 (30%)
Registration fee	-	Rs. 7,500/= per annum
Insurance premium	-	0.25 % of the value of equipment at the year beginning

Power rating of the diesel engine	-	95 kW
Specific fuel consumption	-	0.21 kg/kW/Hour
Specific gravity of diesel fuel	-	0.80
Price of diesel fuel	-	Rs. 44/= per liter
Average engine load factor	-	60 %
Average lubricant/filter change interval	-	400 Hours
Total lubricant capacity	-	15 liters
Average lubricant cost	-	Rs. 140/= per liter
Number of filters to be changed	-	3 per lubricant change interval
Average cost of a filter	-	Rs. 1200/=
Annual Maintenance/Repair cost	-	40 % of annual depreciation
Operator wages	-	Rs. 100/= per hour

(15 Marks)

Section B Construction Safety

Q5.

- i.) Name and briefly explain *five (05)* practices for promoting occupational safety and health at the Planning stage of a Construction Project.
(08 Marks)
- ii.) It is an established fact that psychological attitude towards work, of participants in any group activity will have a significant effect on the success or failure of that activity. This holds true also in the case of construction site safety and health aspects. Describe your opinion on the mental attitudes of workers, which result in poor safety standards at construction sites in Sri Lanka.
(08 Marks)
- iii.) Discuss the basic drawbacks in the Sri Lankan Safety and Health Legislation applicable to construction industry, in relation to present socio/economic and work environment.
(09 Marks)

Q6.

- i.) Clearly describe the main objectives of administering first aid on a **Burn** victim?
(08 Marks)
- ii.) One of the most common medical conditions that need first aid at construction sites are wounds. Clearly define a "Wound" and describe the *five (05)* types of wounds that can be inflicted on a person involved in construction site activities.
(08 Marks)
- iii.) 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.
(09 Marks)