FACULTY OF SCIENCE & TECHNOLOGY

#### MIDLANDS STATE UNIVERSITY

**Mining and Mineral Processing Engineering Department**

**MINE MACHINERY AND MATERIALS HANDLING**

**CODE: HMIE214**

### SESSIONAL EXAMINATIONS

**December 2016**

**DURATION: 3 HOURS**

**EXAMINER: E Z MANDAZA**

## INSTRUCTIONS

1. *Answer* ***ALL*** *questions from* ***Section A*** *and ANY THREE questions from* ***Section*** *B*
2. *Each question carries 20 marks*
3. *Total marks 100*

**SECTION A**

**Question 1**

1. Explain the difference between a pneumatic and hydraulic rock drill impact

stress wave form produced in a drill string. **[3]**

1. How does the hydraulic rock drill impact stress wave result in superior

drilling performance of the hydraulic rock drill over that of the pneumatic rock drill? **[3]**

1. Indicate the consequences of this superior performance of the hydraulic rock

 drill compared to the pneumatic rock drill on earth moving operations . **[3]**

1. In earth moving operations, it is important to determine material that requires

ground breaking through blasting prior to moving the ground. Indicate *two* methods of determining this requirement and explain how they are applied in practice. **[8]**

1. What considerations govern the number of personnel that a winder will be required to carry in underground shaft winding systems? **[3]**

**Question 2**

1. What considerations govern the selection of rope size and type of rope to be used in underground shaft winding systems? **[3]**
2. With the aid of a suitable diagram describe a soil classification system and its application in earth moving systems.  **[10]**
3. Different machines are used in earth moving operations. Define factors used in relating off-site performance to expected site conditions and how the factors are likely to impact on off-site performance. **[7]**

**SECTION B**

**Question 3**

A vertical winder equipped with rope guides has components with the following calculated moments of inertia and masses in Table 3-2. Find the system inertia and the torque required to accelerate the system when the conveyance is at the bottom on the shaft. Assume a gearbox ratio of 40 : 1 and a maximum acceleration rate of 1.5 m/s2. The drum diameter is 2.52 m. Given that acceleration due to gravity is 9.81 ms-2 and friction coefficients for hoisting have been determined as shown in Table 3-1:

Table 3-1: Friction factors for shaft rope winding

|  |  |  |
| --- | --- | --- |
| **Winder type** | **Rope friction** | **Shaft friction** |
| Vertical winding with rope guides | µ = 0.05 | µ = 0.13 |
| Vertical winding with wooden shaft guides | µ = 0.05 | µ = 0.15 |
| Drift haulage winding with good drift tracks | µ = 0.03 | µ = 0.06 |

The Component Inertia and Masses for the system are shown in Table 3-2:

Table 3-2: Component Inertia and Masses for the hoisting system

|  |  |  |
| --- | --- | --- |
| Component | Component Inertia(Kg m2) | Component Mass(kg) |
| Drum | 10017.5 |  |
| Drum shaft | 1.6 |  |
| LS Coupling | 9.3 |  |
| Gearbox | 0.15 |  |
| HS coupling | 3.5 |  |
| HS Brake | 5.2 |  |
| Motor | 35.0 |  |
| Headsheave | 2 500.0 |  |
| Cage |  | 4 200 |
| Rope |  | 2 278 |
| Payload |  | 1 760 |

 **[20]**

**Question 4**

A vertical drum winder is required to carry 20 persons from surface to an underground seam located at a winding depth of 400 m. There is 15 m suspended length of rope between the center of the sheave and the shaft bank as shown in Figure 4-1. Select a rope suitable for the winder from rope specifications in Appendix 4-1. The mass of one miner and equipment is assumed to be 88 kg. A factor of safety of 10 is specified for people riding hoisting systems. The mass of the cage is estimated at 4000 kg and the estimated mass of attachments is 200 kg.

Given: 1 lb = 0.453 59 kg; 1 ft = 0.304 80 m. **[20]**



Figure 4-1

**Question 5**

A coal mining company is considering the recovery of a 5.5 m seam under an average of 40 m overburden using a dragline. The dragline will use a straight side-casting method. A contract to be signed requires 2 million tons of coal to be mined annually. Select the reach requirements and minimum bucket capacity for the dragline and from the attached specifications in Appendix 5-1 indicate the most appropriate operating dragline boom length and boom angle for a dragline working to the given specifications. The site working conditions are given as:

* Coal weight: 1.5 t/m3
* Recovery: 90%
* Overburden swell: 33%
* Overburden density (in place): 2.3 t/m3
* High wall angle (ϕ): 660
* Soil angle of repose (θ): 350
* Pit width: 40 m
* Average dragline efficiency: 0.81
* Bucket factor: 0.90
* Dragline schedule: 720 hours per month

**[20]**

**Question 6**

Calculate the hourly production for a D65PX-16 Komatsu dozer using a straight tilt blade operating over 50 muphill on a gradient of 5%. The job efficiency is estimated at 50 minutes per hour, with an average blade factor. Specifications for Komatsu dozers are shown in Appendices 6-1 to 6-5. **[20]**



Appendix 4-1



Appendix 5-1

Appendix 

Appendix 6-1



Appendix 6-2

Appendix 6-3



Appendix 6-4

Appendix 6-5