NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND BUILT ENVIRONMENT

DEPARTMENT OF CIVIL, MINING AND PROCESS ENGINEERING

QUALIFICATION: BACHELOR OF MINING ENGINEERING	
QUALIFICATION CODE: 08BMIN	**LEVEL: 7**
COURSE CODE: MHD721S	**COURSE NAME: MATERIALS HANDLING 324**
SESSION: NOVEMBER 2022	**PAPER: THEORY**
DURATION: 3 HOURS	**MARKS: 100**

SECOND OPPORTUNITY QUESTION PAPER	
EXAMINER(S)	**Mr H.K Hengari**
MODERATOR:	**Mr L. Madziwa**

INSTRUCTIONS
1. Answer all questions. 2. Read all the questions carefully before answering. 3. Marks for each question are indicated at the end of each question. 4. Please ensure that your writing is legible, neat and presentable.

PERMISSIBLE MATERIALS

1. Examination paper.
2. Calculator and appropriate stationery

THIS QUESTION PAPER CONSISTS OF 7 PAGES (Including this front page)

Question 1 [20marks]

A 800 mm wide conveyor belt is to be designed for coal (SG =0.96 and surcharge angle 15) haulage up a 600 m-long 10° at 2.8 m/s. The belt is a 3 idlers belt, troughing at 30 degrees The belt drive will have a counterweight, lagged pulley, and a 240° arc of contact.

a) What is the production of the rate of the conveyor belt? (4 marks)
b) The mine requires 600 t/hr and the opted to increase production by changing the belt width to 900 mm. Estimate the required tensions on both sides of the belt, assuming moderate operating conditions Estimate the required tensions on both sides of the belt. (10 marks)
c) Discuss the consideration for selecting a belt for hauling crushed ore? (6 marks)

Question 2 [20 marks]

a) A mine is considering following three different acquisition methods to obtain a dozer for. The alternatives are
    1 Immediate cash purchase the dozer for N$ 1 682 000 each and sell after 4 years for an estimated price of N$ 500 000.
    2 Purchase the truck using a time payment plan requiring an immediate down payment of N$ 400 000 and N$ 450 000 at the end of each year for 3 years. Assume truck will sold for N$ 500 000 each after 4 years.
    3 Lease the dozer for 4 years for N$ 400 000 per year paid in advance at the beginning of each year. The mine pay all operating and maintenance cost for the dozer, ownership retains with lessee

If the marginal rate of return is 9.25%, then determine the best choice to buy the trucks (10 marks)

b) Discuss how the mine location and the mining method will affect the choice of equipment to be used. (10 marks)

Question 3 [20 marks]

Mine water is one of the materials that must be moved in mining operations, where pumps are often used to dewater pits and tunnels.

a) Discuss four (4) the advantages of using pumps as a materials handling system? (8 marks)

b) In a mine waterlogged workings must be dewatered. The distance from the pit bottom sump to the dip most face up to which dewatering will have to done is 1200 m. The water level difference between the bottom most point and pit bottom sump are 200 m. The total quantity of water in the lodgment to be pumped out is 12000 kilo liters and the percolation from the strata in 24 hours is 2000 kilo liters. It has been decided to pump out the water in 30 days. Net hours of run of the pump is 20 hours per day. Available pipe is of 150 mm diameter. Coefficient of friction of pipe range is 0.015. The overall efficiency of pumping set is 75%. Calculate:

i. Flow rate by the pump in m^3/hr (5 marks)
ii. Total head that the pump must overcome. Ignore shock losses (5 marks)
iii. The power of the pump set you need to install, if the density is 1100 kg/m^3(2 marks)

Question 4 [20 marks]

a) A certain mining operation intends to strip the overburden from a 1.8 m coal seam to meet a contractual agreement to supply 1 Mt of coal per year. With the given the following information, determine the limiting depth for this dragline. (5 marks)

Overburden swell: 0.30
Pit width: 20 m
Dumping radius of the shovel: 35 m
Tub Diameter: 10 m
Highwall angle of repose: 70°
Spoil angle of repose: 35°

b) A CAT77D truck weighs 64 670 kg empty and 155 070 kg when loaded. This truck has one front axle (2 tyres) and one rear axles (4 tyres). The axle weight distribution empty is 47% front and53% rear. The weight distribution loaded is 33% front and 67% rear. The truck works a 8-hr shift hauling blasted material. The one-way haul distance is 6 km. The truck can make 16 trips per shift. What TKPH rating tyres will be sufficient for this operation? (10 marks)
c) List five (5) hazards that are associated with loading and hauling operations (5 marks)

Question 5 [20 marks]

Given the following data work out the design parameters of a double drum hoist:

Two balanced skips, tower mounted hoist.
Production rate = 400 t/hr
Shaft depth = 520 m
Hoist round stranded
Skip weight = 6 tonnes
live load =8.25 tonnes
Load time = dump time = 6 sec
Acceleration = retardation = 10 s

Calculate the following:

a) What is the full speed time for this operation? (5 marks)
b) Minimum rope diameter to be used in this operation (5 marks)
c) Sheave diameter and length (5 marks)
d) What are the advantages of drum hoists in relation to friction hoists? (5 marks)

Formula Sheet

$T_e = T_1 - T_2$	$m_G = \frac{Q}{3.6v}$	$EAC = \frac{Pi}{\left(1 - \frac{1}{(1+i)^n}\right)}$
$p = \frac{T_1 + T_2}{NDd}$	$SF = \frac{25000}{4000 + H}$	$T_e = T_2 K$
$Rdd - 0.75Et$	$Tension = \frac{T_{max}}{B}$	$d = \sqrt{\frac{L}{N\left(\frac{K_1}{SF} - K_2 H\right)}}$
$P = \frac{\rho g H Q}{\eta}$	$P = \frac{S}{(1+i)^n}$	$P_A = \frac{T_e V}{\eta}$
$h_L = \frac{flv^2}{2gd} + K_L \frac{v^2}{2g}$	$L_d = \frac{SH}{\pi D} + 7S$	$T_{c\,min} = \frac{l_c^2 (m_b + m_G) g}{8S}$
$1.05d$	$T_{r\,min} = \frac{l_r^2 (m_b) g}{8S}$	$Rd = \frac{H}{\tan\phi} + \frac{1}{\tan\theta}\left[H(1+S) + \left(\frac{W}{4}\tan\theta\right) - T\right]$

$$T_e = afLg\{m_{idlers} + (2m_b + m_G)\cos\delta\} + R_s + m_G g L \sin\delta$$

Belt Width (mm)	Belt Width (in)	Operating Conditions		
		Light Duty kg/m (lb/ft)	Medium Duty kg/m (lb/ft)	Heavy Duty kg/m (lb/ft)
500	20	4.1 (2.75)	6.2 (4.16)	10.3 (6.92)
600	24	5.0 (3.36)	7.4 (4.97)	12.3 (8.26)
750	30	6.2 (4.16)	9.3 (6.25)	15.5 (10.41)
900	36	7.4 (4.97)	11.1 (7.46)	18.5 (12.43)
1050	42	8.6 (5.78)	13.0 (8.73)	21.6 (14.51)
1200	48	9.8 (6.58)	14.8 (9.94)	24.7 (16.60)
1350	54	11.0 (7.39)	16.7 (11.22)	27.8 (18.68)
1500	60	12.3 (8.26)	18.6 (12.50)	30.9 (20.76)
1650	66	13.5 (9.07)	20.5 (13.77)	33.9 (22.78)
1800	72	14.7 (9,88)	22.3 (14.98)	37.0 (24.86)

Belt Width (mm)	Belt Width (in)	Mass of Moving Parts (kg/m) (lb/ft)			
		Light Duty 4" Idlers **Light Belt**	Medium Duty 5" Idlers **Moderate Belt**	Heavy Duty 6" Idlers **Heavy Belt**	Extra Heavy Duty 6" Idlers **Steel Cord Belt**
450	18	23 (15.4)	25 (16.8)	33 (22.2)	
600	20	29 (19.5)	36 (24.2)	45 (30.2)	49 (33.0)
750	24	37 (25.0)	46 (31.0)	57 (38.3)	63 (42.3)
900	30	45 (30.0)	55 (37.0)	70 (47.0)	79 (53.0)
1050	36	52 (35.0)	64 (43.0)	82 (55.0)	94 (63.2)
1200	42	63 (42.3)	71 (47.7)	95 (63.8)	110 (74.0)
1350	48	70 (47.0)	82 (55.0)	107 (72.0)	127 (85.3)
1500	54		91 (61.2)	121 (81.3)	143 (96.0)
1650	60		100 (67.2)	132 (88.7)	160 (107.5)
1800	66			144 (96.7)	178 (119.6)
2100	72			168 (112.8)	205 (137.7)
2200	84			177 (119.0)	219 (147.2)

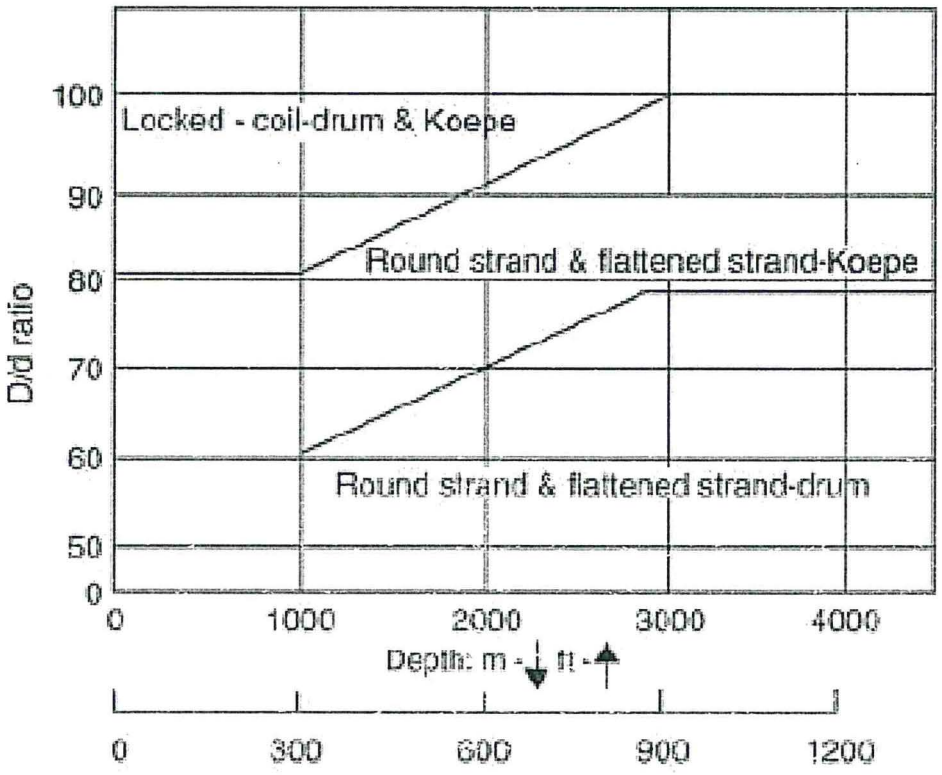
TABLE 1

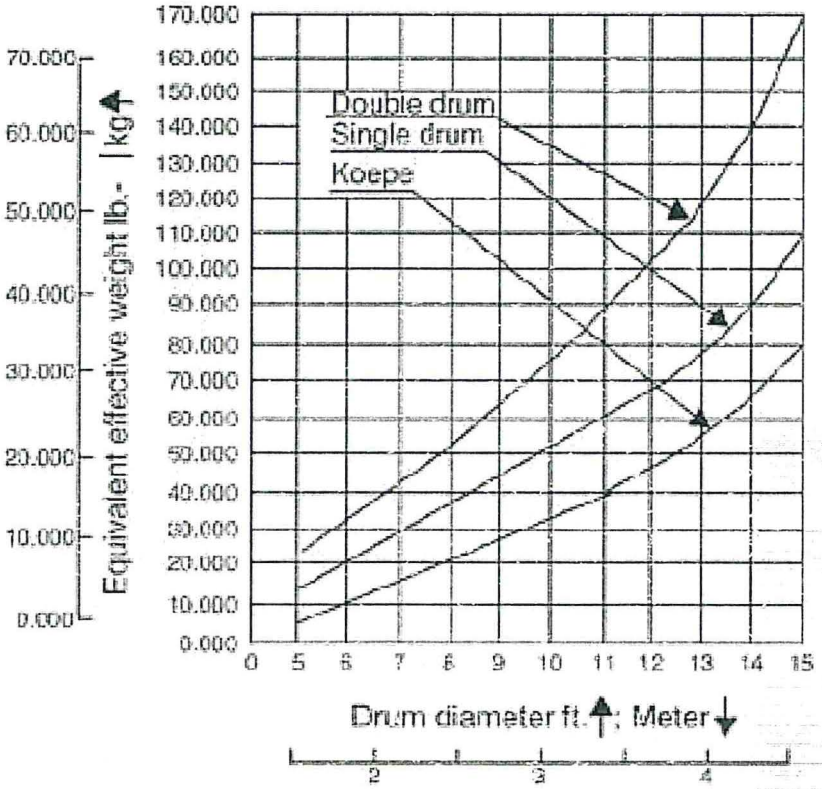
STANDARD DRIVE FACTOR "K" VALUES

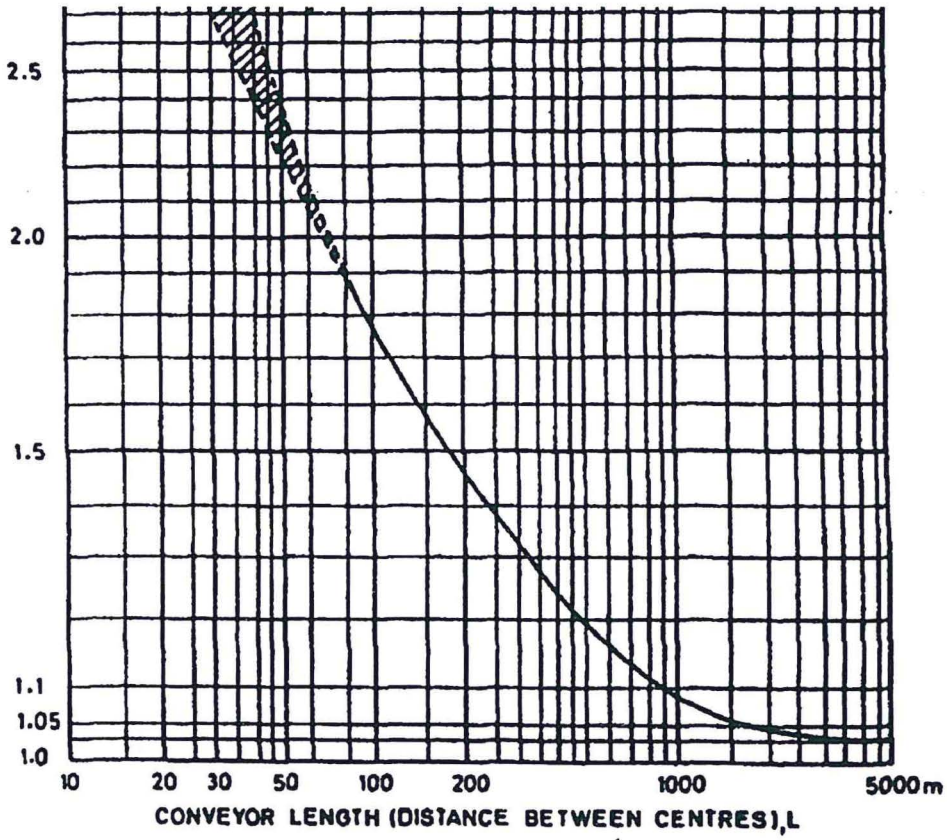
ARC OF CONTACT (Degrees)	COUNTERWEIGHT TAKE-UP		SCREW TAKE-UP	
	Bare pulley $\mu = 0.30$	Lagged pulley $\mu = 0.35$	Bare pulley For 20% higher T_1	Lagged pulley For 20% higher T_1
Single pulley				
*180	0.64	0.50	0.97	0.90
*210	0.50	0.38	0.80	0.66
*220	0.46	0.35	0.76	0.63
*230	0.43	0.32	0.72	0.59
*240	0.40	0.30	0.68	0.56
270	0.32	0.24	0.58	0.49
Tandem Pulley				
360	0.18	0.13	0.42	0.36
390	0.15	0.11	0.39	0.33
*420	0.13	0.09	0.36	0.31
*440	0.11	0.07	0.34	0.30
*450	0.11	0.07	0.33	0.29
*460	0.09	0.06	0.32	0.29
480	0.09	0.06	0.31	0.27

*** Arc of contact commonly met in actual practice**

Rope design	Rope Weight (kg/m)	Rope Strength (kN)
Round Strand	$0.0036d^2$	$0.59d^2$
Flat rope	$0.0041d^2$	$0.63d^2$
Locked coiled	$0.0056d^2$	$0.85d^2$


D/d ratio
100
90
80
70
60
50
0
Locked - coil-drum & Koepe
Round strand & flattened strand-Koepe
Round strand & flattened strand-drum
0
1000
2000
3000
4000
Depth: m - ft -
0
300
600
900
1200


Equivalent effective weight lb. - kg
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
170.000
160.000
150.000
140.000
130.000
120.000
110.000
100.000
90.000
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
Double drum
Single drum
Koepe
0
5
6
7
8
9
10
11
12
13
14
15
Drum diameter ft.; Meter
2
3
4



Belt Width mm	Surcharge Angle	Trough Angle 20°	25°	30°	35°	40°	45°
500	0°	0.009 8	0.012 0	0.013 9	0.015 7	0.017 3	0.018 6
	10°	0.014 2	0.016 2	0.018 0	0.019 6	0.021 0	0.022 0
	20°	0.018 7	0.020 6	0.022 2	0.023 6	0.024 7	0.025 6
	30°	0.023 4	0.025 2	0.026 6	0.027 8	0.028 7	0.029 3
650	0°	0.018 4	0.022 4	0.026 0	0.029 4	0.032 2	0.034 7
	10°	0.026 2	0.029 9	0.033 2	0.036 2	0.038 6	0.040 7
	20°	0.034 2	0.037 7	0.040 6	0.043 3	0.045 3	0.046 9
	30°	0.042 7	0.045 9	0.048 4	0.050 7	0.052 3	0.053 4
800	0°	0.027 9	0.034 4	0.040 2	0.045 4	0.050 0	0.054 0
	10°	0.040 5	0.046 6	0.051 8	0.056 4	0.060 3	0.063 6
	20°	0.053 5	0.059 1	0.063 8	0.067 8	0.071	0.073 6
	30°	0.067 1	0.072 2	0.076 3	0.079 8	0.082 2	0.084 0
1 000	0°	0.047 8	0.058 2	0.067 7	0.076 3	0.083 8	0.089 8