UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACCALAURIUS TECHNOLOGIAE *MINING ENGINEERING*
SUBJECT	:	**MINING TECHNICAL SERVICES IVA**
CODE	:	**MTLA411**
DATE	:	SSA ASSESSMENT 27 JULY 2016
DURATION	:	3 HOURS (08:00 – 11:00)
WEIGHT	:	60% OF FINAL MARK
TOTAL MARKS	:	100

EXAMINER	:	MR H STRAUSS
MODERATOR	:	MR D J McDOUGALL
NUMBER OF PAGES	:	7

INSTRUCTIONS	:	ANSWER ALL QUESTIONS
REQUIREMENTS	:	INFORMATION BOOKLET (TO BE HANDED IN) ONE SCRIPT (SECOND ON REQUEST) BOOKLETS AND GRAPHS MUST BE HANDED IN

INSTRUCTIONS TO CANDIDATES:

READ THE QUESTIONS THOROUGHLY BEFORE YOU START
ANSWER ALL THE QUESTIONS
SHOW ALL CALCULATIONS AND SI UNITS (NONE SHOWN = NO MARKS)
DO NOT USE CORRECTION FLUID, NEITHER A PENCIL, NOR A RED PEN
HAND IN ALL YOUR WORK AS WELL AS THE BOOKLET
DO YOUR OWN WORK – EARN YOUR MARK WITH PRIDE

QUESTION 1

1.1 In terms of the DMR Guideline on thermal stress, state four items that are regarded as safe work practices expected from supervisors, irrespective of the level of supervision. (5)

1.2 Distinguish between the following terms:

1.2.1 Enthalpy and Sigma heat. (2)
1.2.2 Work and power. (2)
1.2.3 Heat and temperature. (2)
1.2.4 Latent heat and sensible heat. (2)
1.2.5 Gauge pressure and absolute pressure. (2)

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QUESTION 2

The tabulation below shows the data collected from measurements taken in a refrigeration plant. Using this data, calculate the following:

Item	Value	Unit
Evaporator water temperature in	21,2	^{0}C
Evaporator water temperature out	4,7	^{0}C
Bulk air cooler water temperature in	7,4	^{0}C
Bulk air cooler water temperature out	18,7	^{0}C
Condenser water temperature in	14,7	^{0}C
Condenser water temperature out	27,7	^{0}C
Compressor motor current	280	A
Compressor motor voltage	6,6	kV
Power factor	0,92	

Given that the heat exchange in the evaporator is 9,810MW, and the heat exchange in the condenser is 13,204MW, calculate the following:

2.1 Evaporator water flow rate. (2)
2.2 Condenser water flow rate. (2)
2.3 Bulk air cooler Positional Efficiency. (2)
2.4 Overall Plant Coefficient of Performance. (3)

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QUESTION 3

3.1 An air stream of $14m^3/s$ enters a working area at a temperature of 24/27°C, and a barometric pressure of 105kPa. In the area, a diesel powered dump truck with a rated output power of 240kW, and an overall efficiency of 34%, is hauling ore along a horizontal haul road for a distance of 600m. Estimate the air temperature at the return side of this working area. Assume that the moisture content increases by 20%, and ignore all other possible external heat sources. (5)

3.2 If the maximum allowable return air wet bulb temperature is 29°C, by how much must the intake air wet bulb temperature be reduced? (3)

3.3 What cooling rate would be required to achieve this? (Assume that the original mass flow is applicable). (2)

3.4 If you have a spot cooler available at the intake, how much cooling water would be required to deliver this cooling rate, given that the water temperature increase in the spot cooler will be 8°C? (3)

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QUESTION 4

4.1 In terms of stone dust sampling, as prescribed by the DMR:

4.1.1 What is the purpose of stone dust sampling? (1)

4.1.2 Mention two requirements set for "Compliance sampling". (2)

4.1.3 Describe the required procedure for preparation and evaluation of collected dust samples. (4)

4.3 Construct a Coward's Diagram for the gas mixture given below.

Methane:	4%
Carbon Monoxide:	6%
Oxygen:	12%

You may use the chart template attached. (6)

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QUESTION 5

5.1 Briefly discuss two types of errors that may occur in monitoring instruments. (4)

5.2 Mention two items that should be monitored in tabular hard rock stopes, also giving an example of the instruments required for each. (4)

5.3 Briefly describe how a seismic event is located is space and time. Your description must include the science and technology applied. (6)

5.4 You have a stope that is approaching a fault at a depth of 2 600m. It is estimated that the state of stress on the fault will soon be as given in the two dimensional matrix below. The fault is dipping at an angle of 47° above the horizontal, and it has a friction angle of 31°. Determine whether slip would be likely once this stress state occurs.

$$\begin{vmatrix} 46 & -18 \\ 18 & 96 \end{vmatrix}$$ (6)

5.5 You have been tasked to design a support system for a shallow tabular stoping operation, of which the details are tabulated below. Present your detailed solution. (7)

Stope width	110cm
Dip	14°
Rock density	3 250kg/m^3
Depth (mean)	750m
Face configuration	Overhand, gully depth = 80cm.
Failure mode anticipated	Shear failure, one joint set, dipping at 40°, with a joint density of 5/m.
Support units	150kN, 25cm thick.
Head boards	Nil
MRMR	Not done
RQD	69%
Fall out height	100cm

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QUESTION 6

6.1 In terms of monitoring, van der Merwe described three levels; mention each level, as well as its objective. (6)

6.2 Describe the procedures to:

6.2.1 Determine the absolute stress at a point in the rock mass. (3)

6.2.2 Determine a stress change in the rock mass. (3)

6.3 You have to design a support system for an underground coal mining section. The immediate roof is made up of two layers as follows:

Layer	Description	Thick-ness (m)
Top	Sandstone.	0,6
Bottom	Laminations (25mm) of Mudstone and Sand-stone (alternating layers).	0,6

You intend using mechanical anchors with 16mm diameter stems that have a yield strength of 450Mpa. Tests have shown that the anchors slip at a load of 40kN.
Conduct a full design sequence (using a safety factor of 1,5) and make recommendations regarding the bolt spacing and length. (11)

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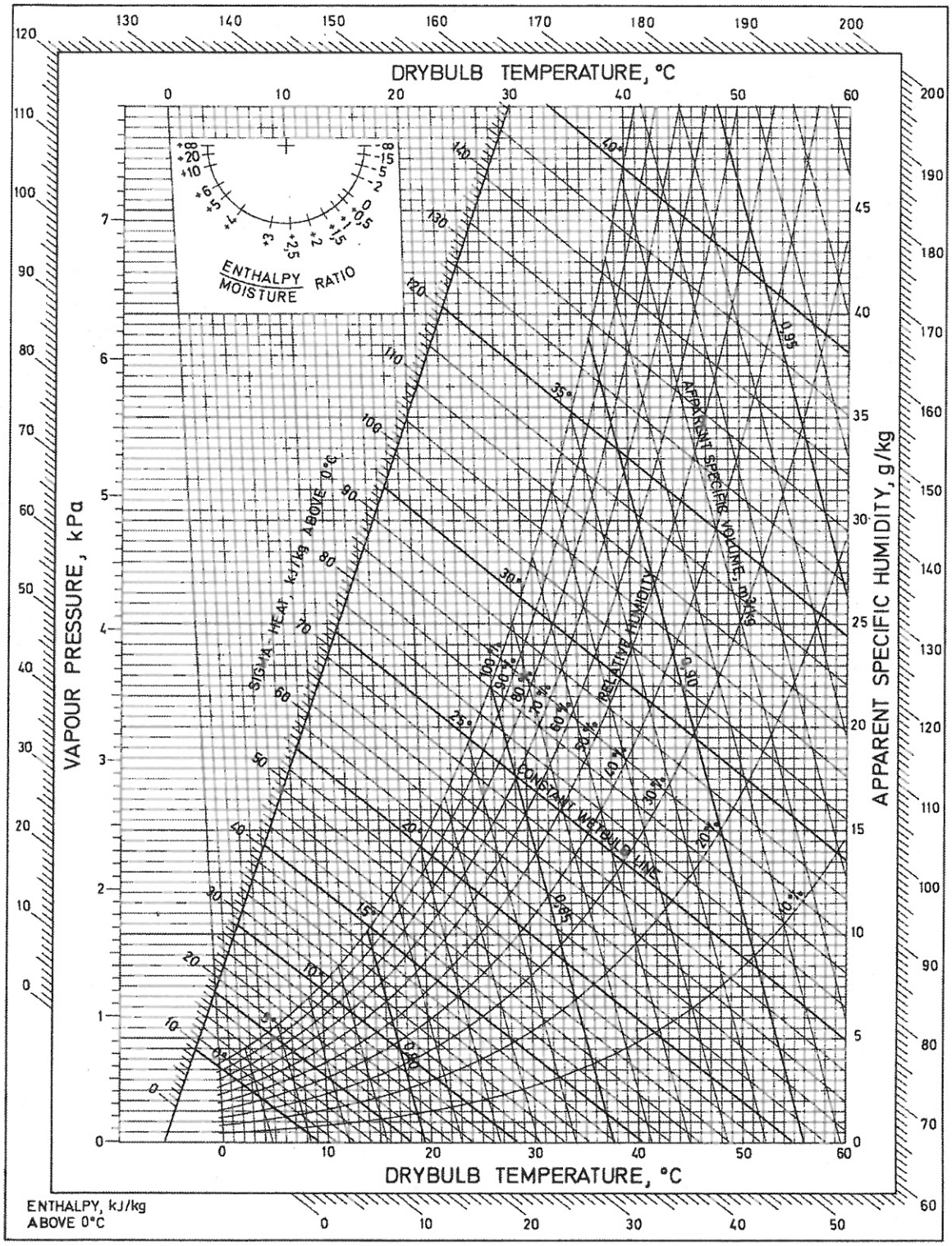
TOTAL **[100]**

105,0 kPa


DRYBULB TEMPERATURE, °C
VAPOUR PRESSURE, kPa
APPARENT SPECIFIC HUMIDITY, g/kg
ENTHALPY / MOISTURE RATIO
ENTHALPY, kJ/kg ABOVE 0°C
SIGMA-HEAT, kJ/kg ABOVE 0°C
APPARENT SPECIFIC VOLUME, m³/kg
RELATIVE HUMIDITY
CONSTANT WET-BULB LINE

If used, detach and hand in with your script.

Student Number .....