PROGRAM	NATIONAL DIPLOMA *EXTRACTION METALLURGY*
SUBJECT	**METALLURGICAL PLANT II**
CODE	**MTP21-1**
DATE	EXAMINATION 19 November 2016
DURATION	(SESSION 2) 12:30 - 14:30
WEIGHT	50 : 50
TOTAL MARKS	109

ASSESSOR	Mrs BONGEPHIWE M. KANYANE
MODERATOR	Ms MAPILANE MADIBA
NUMBER OF PAGES	4 PAGES

INSTRUCTIONS

- You must clearly demonstrate how you arrived at a given answer, results alone are insufficient.
- Calculators are permitted.

QUESTION 1 [10]

Design

What are five steps of flowsheet development?

QUESTION 2 [20]

Thermodynamics

When iron ore (Fe_2O_3) is reacted with coke (C) the products are iron (Fe) and CO_2. Thermodynamic properties of this reaction at room temperature (298 K) are given below.

$\Delta H° = 465$ kJ/mol (289 K)

$\Delta S° = 0.552$ kJ/mol (298 K)

2.1 Determine whether this reaction is possible at 298 K.

2.2 Assuming that $\Delta H°$ and $\Delta S°$ will not change with temperature, determine the temperature at which this reaction will be spontaneous.

QUESTION 3 [10]

True / false

State whether the following statements are true or false:

3.1 A block diagram has to include the control sensors and transmitters.

3.2 The second law of thermodynamics states that energy cannot be created or destroyed.

3.3 In the conveyor belt, impact idlers are located below the feeding point.

3.4 In radiation heat transfer the emissivity of a grey body is 1.

3.5 In a compression settling zone of a thickener, the velocity of a settling particle is negligible.

QUESTION 4 [24]

Settling / thickening

A slurry enters a thickener at a rate of 200 m^3/h. The height of a thickener is 20 m and its length is 25 m. Without a flocculent the critical settling velocity is 690 mm/h.

4.1 Determine the detention time of the particles.

4.2 When the flocculent is added the critical settling velocity increase 3 times, how will this affect the detention time?

4.3 Estimate the surface area of this thickener for conditions without a flocculent.

QUESTION 5 [20]

Heat transfer

Heated water is carried by a copper pipe which has a diameter of 40 mm. The external surface temperature of the pipe is 90 °C, the temperature of the surroundings is at 35 °C. The temperature of the water inside the pipe is 98 °C. The thermal conductivity of copper is 370 W/m^2. K. Conductive heat transfer from the inside of the pipe to the outside is 25 0000 W/m^2, assume the inner pipe temperature is equal to the water temperature.

5.1 What is the thickness of the pipe per square meter?

5.2 Assuming that the pipe acts as a black body, the pipe loses heat to its surrounding by radiation. What is the heat loss by the pipe to its surrounding by radiation? Stefan Boltzmann's constant = 5.67×10^{-8} $W.m^{-2}.K^{-4}$

QUESTION 6 [18]

Forces and moments

A maximum load of 150 kN is exerted on a steel pipe with a diameter of 50 cm. The initial length of the pipe is 90 cm, the pipe is stretched to 105 cm before it fractures. The load at limit of proportionality is 95 kN, the pipe is stretched to 98 cm at limit of proportionality.

Calculate the Young's modulus of elasticity.

MTP21-1 METALLURGICAL PLANT II