UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACHELOR OF ENGINEERING TECHNOLOGY *EXTRACTION METALLURGY*
SUBJECT	:	**METALLURGICAL ACCOUNTING A2**
CODE	:	**MEAMTA2**
DATE	:	WINTER EXAMINATION 25/05/ 2019
DURATION	:	(X-PAPER) 08:30 - 11:30
WEIGHT	:	40: 60
TOTAL MARKS	:	50
FULL MARKS	:	50

EXAMINER	:	MR. Craig NSAKABWEBWE
MODERATOR	:	MS M MADIBA

NUMBER OF PAGES	:	6 PAGES

INSTRUCTIONS :

1. QUESTION PAPER MUST BE HANDED IN.
2. AN INDIVIDUAL FORMULA SHEET IS ALLOWED.

INSTRUCTIONS TO CANDIDATES:

1. PLEASE ANSWER ALL THE QUESTIONS.
2. QUESTION 1 REFERS TO THE COMPLEX COPPER CONCENTRATION CIRCUIT SHOWN IN FIGURES 1a and 1b.
3. QUESTIONS 2 AND QUESTION 3 REFER TO THE TIN CONCENTRATOR PLANT SHOWN IN FIGURE 2.

DESCRIPTION OF A COMPLEX COPPER CONCENTRATION CIRCUIT

The flowsheet of a copper concentration circuit is shown in figure 1a. The circuit has been reduced in node form in figure 1b.

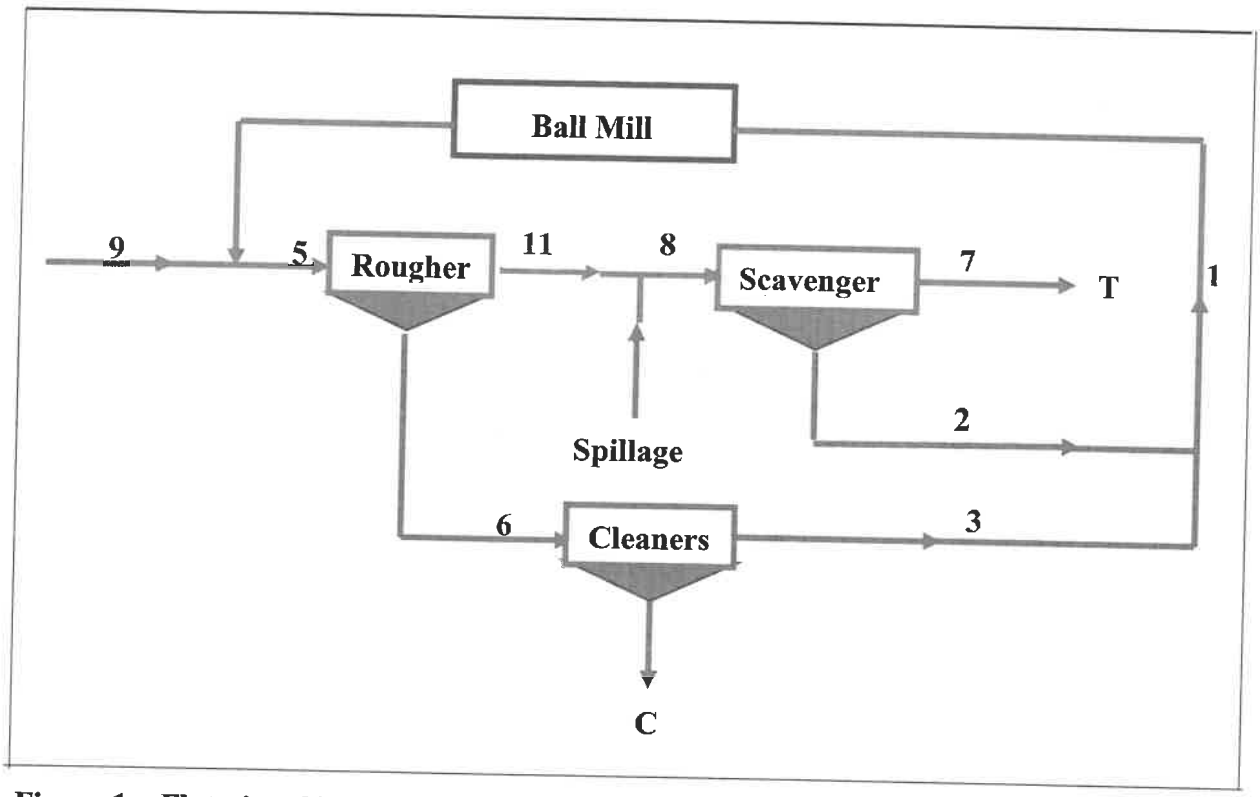

Figure 1a. Flotation Circuit

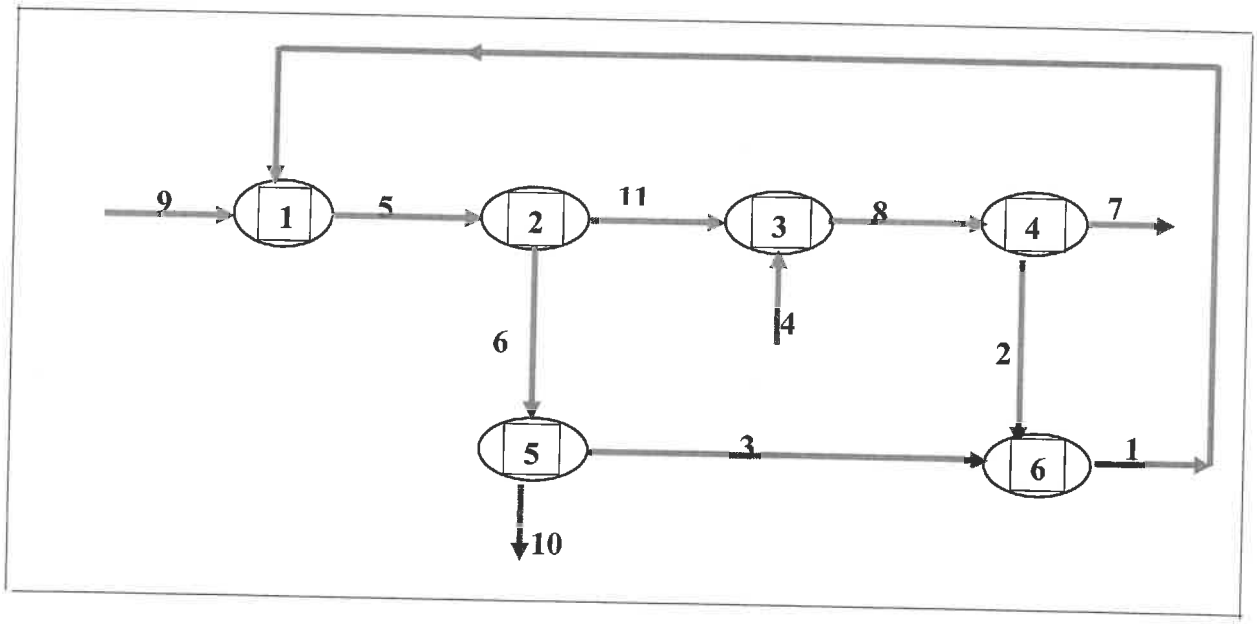

Figure 1b. Flotation Circuit in Node Form

DESCRIPTION OF A TIN CONCENTRATOR PLANT

A section of a concentrator treating a tin ore is shown in figure 2. The section treats 0.5 dry tonne of cassiterite per minute of feed (density of solids 2.5t/m^3).The ore containing 10% moisture is fed into the ball mill which discharges a pulp of density 1.6393 t/m^3 after a water addition. Water has been added to the ball mill discharge which gives a pulp of density 1.21951 t/m^3 before being pumped to hydrocyclone. The classification in the hydrocyclone produces an underflow of slurry density 1.315789 t/m^3 and an overflow of pulp density 1.09890t/m^3.

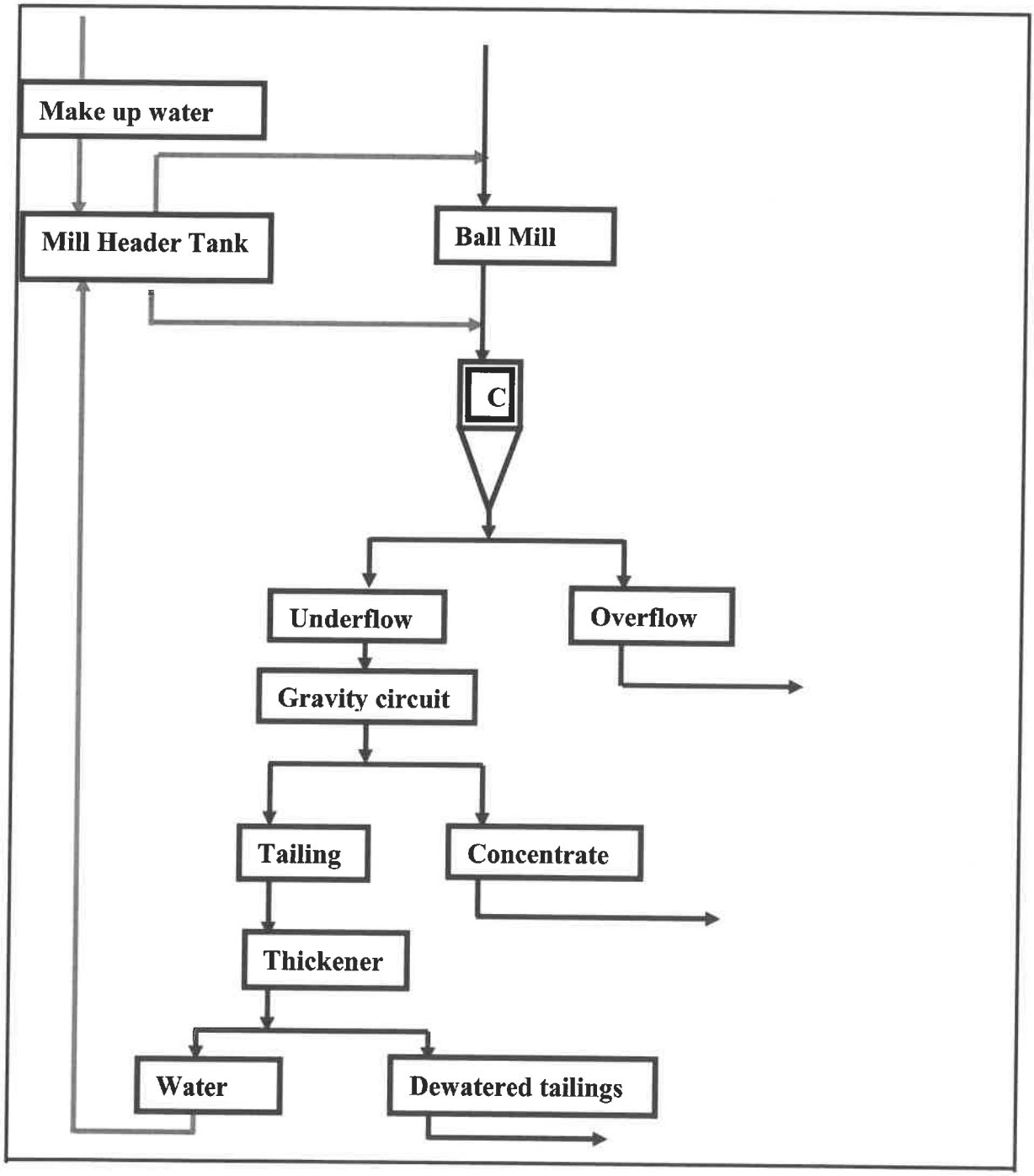

Figure 2. Tin Concentrator Circuit

The cyclones underflows are fed to a gravity concentration circuit consisting of a shaking table separation. The chemical composition of the concentration products are shown in the Table 1.

The tailing of pulp density 1.21951219 t/m^3 is dewatered to a density of 1.639344 t/m^3 in the thickener which supplies water to the ball mill feed and cyclone feed.

Table 1: Products of the gravity circuit

Component	Actual assays %		
	Feed	Conc.	Tails
Tin	20.9	42.0	5.77
Fe	2.46	4.50	1.76
SiO_2	57.0	24.1	74.3
S	0.11	0.12	0.09
As	0.36	0.38	0.34
TiO_2	3.91	8.24	1.07

Question 1(10 MARKS)

With the aid of a connection matrix, determine the minimum number of stream that need to be sampled in order to produce a complete circuit mass balance.

Question 2(30 MARKS)

2.1. Determine the adjusted assays of elements in the various products of the gravity concentration circuit. The adjusted assays are consistent with the calculated best-fit flow rates of the gravity circuit. **(5)**

2.2. From the adjusted data, calculate the recovery of tin at the gravity circuit. **(5)**

2.3. Determine the uncertainty of Sn recovery. It is assumed that all the products can be assayed to a relative standard deviation of 8 % at 95% confidence level. **(5)**

2.4. Based on the adjusted grades of Sn obtained at the gravity circuit; determine the annually performance of the plant by completing the Table 2 below: **(10)**

Table 2.Annualy Performance of the Plant

Item	Weight (t)	Assay (%)	Weight Metal (t)	Distribution Metal (%)
Feed				
Concentrate				
Tails				

2.5. Determine the flow rate of make-up water required for the header tank. **(5)**

QUESTION 3 (10 MARKS)

With the aid of a neat diagram, explain how you could apply a feed-forward control loop for the control of grade in the concentrate obtained from gravity circuits (supposed shaking table).Label all the elements making your neat diagram.