UNIVERSITY
OF
JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA
		ENGINEERING METALLURGY
SUBJECT	:	**FOUNDRY TECHNOLOGY II**
CODE	:	**FTY21-1**
DATE	:	WINTER EXAMINATION
		30 May 2018
DURATION	:	(Y-PAPER) 12:30 - 15:30
WEIGHT	:	40: 60
TOTAL MARKS	:	95
FULL MARKS	:	90

EXAMINER	:	DR K. NYEMBWE
MODERATOR	:	MR CL JONES (EXTERNAL)
		DR K KATUKU (INTERNAL)
NUMBER OF PAGES	:	4 PAGES

INSTRUCTIONS:

QUESTION PAPER MUST BE HANDED IN

INSTRUCTIONS TO CANDIDATES:

PLEASE ANSWER ALL THE QUESTIONS.

QUESTION 1 (35 MARKS)

The input and output flows of greensand mullor are schematically shown in Figure 1. The mullor supplies two CT6 jolt squeeze moulding machines. One moulding machine is dedicated for the production of copes while the other machine is for the production of drags. Complete moulds are assembled at a rate of 120 moulds/ hour. The CT6 machines have the following characteristics:

- Flask dimensions: 600 X 400 X 110 mm^3

- Weight of the greensand for the cope: 30 kg

- Weight of the greensand to produce the drag: 35 kg

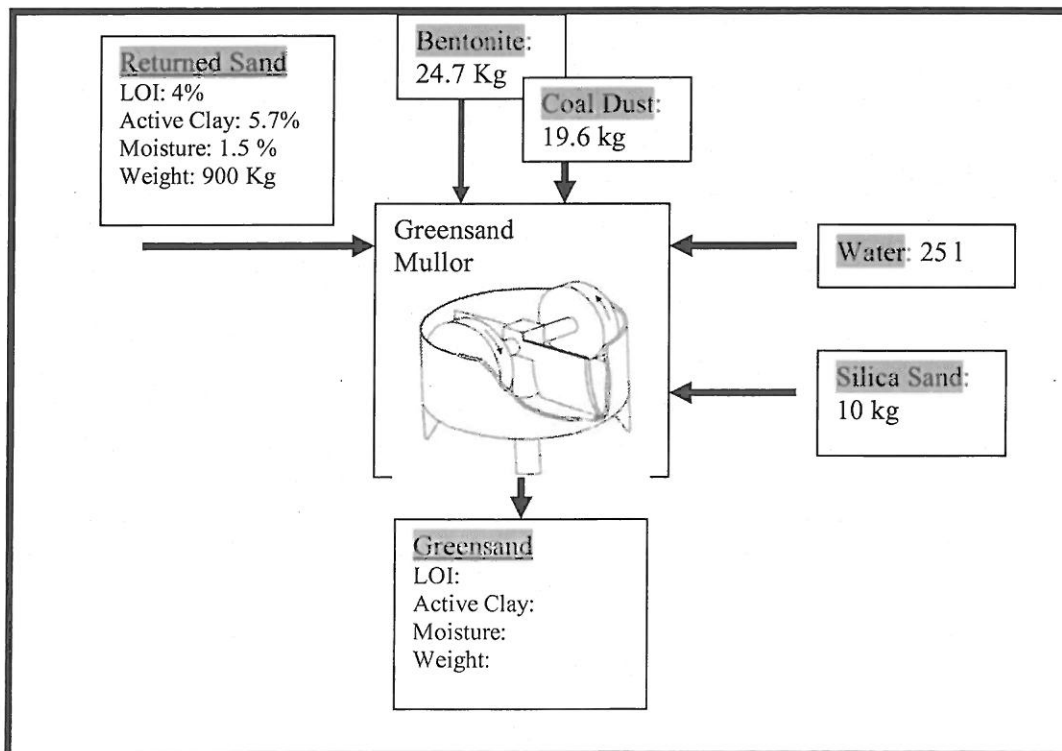- Average casting weight in the mould: 13.6 kg

- Casting density: 7.2 g/cm^3

Figure 1. Additions of raw materials around a greensand mullor

1.1   **Determine the following:**

1.1.1   The composition of the greensand in terms of

1.1.1.1 Moisture (1)

1.1.1.2 Active clay (2)

1.1.1.3 Moisture (2)

1.1.2   The average sand density in kg/m^3 achieved by the moulding machines (5)

1.1.3   The average sand to iron ratio of the greensand plant (2)

1.1.4   The total quantity of silica sand addition to produce 11 tons of castings per day (3)

1.2   **Explain the functioning principle of a jolt squeeze machine (4)**

1.2.1   With the aid of a neat diagram, show the variation of mould hardness in a section of the cope produced by a jolt squeeze machine (2)

1.2.2   Explain the importance of the compaction (density) achieved by the moulding machine for the soundness of the casting. Illustrate with two examples (4)

1.3   **Give and explain two advantages of an alternative refractory sand to silica sand that could be used in this foundry (5)**

1.4   **The cope and drag are coated with graphite paint prior to mould assembly. Give and explain two advantages of this practice (5)**

QUESTION 2 (35 MARKS)

A foundry operates a coreless induction furnace lined with an alumina refractory material. The capacity of the melting furnace is 5 tons. The monthly production of casting in this foundry is 200 tons. The characteristics of melting raw materials available for furnace charge are shown in Table 1.

Table 1. Chemical compositions of melting raw materials.

Material		Addition Rate [%]	Price [R/Kg]	C [%]	Si [%]	Mn [%]	S [%]	P [%]	Fe
Primary melting	Pig Iron	10	5	4.5	1.5	0.1	0.1	0.08	Remainder
	Steel Scrap	30	1.1	0.3	0.2	0.8	0.05	0.05	Remainder
	Foundry returns	60	-	3.2	2.7	0.6	0.1	0.8	Remainder
Additions	Graphite	(b)	8	99.5	-	-	0.09	-	-
	FeSi	(c)	25	-	75	-	-	-	25
	FeMn	(d)	19	-	-	80	-	-	20

2.1 Calculate the following:

2.1.1. The monthly requirement of graphite, FeSi and FeMn addition for the melting to produce a grade 150 grey cast iron alloy with the chemical composition shown in Table 2. Assume there is no loss of elements during melting. Show all the steps.

Table 2. Chemical composition of grey iron grade 150

C	Si	Mn	S	P
3.1-3.4%	2.5-2.8%	0.5-0.7%	0.15% Max	0.5 % Max

(10)

2.1.2. Determine the cost in Rand/ton of producing the alloy in the foundry   (5)

2.2 Explain the functioning principle of a coreless induction melting furnace (6)

2.3 Explain two functions of the Alumina refractory lining of the furnace. (4)

2.4 With the aid of appropriate diagram, explain the effect of inoculation on the microstructure of gray cast iron (10)

QUESTION 3 (10 MARKS)

With the aid of neat diagrams, discuss one application of **Three Dimensional (3D) Printing to Metal Casting** along the following lines:

3.1. Raw materials used (2)

3.2. Principles (4)

3.3. Advantages and limitations in the context of Metal Casting (4)

QUESTION 4 (15 MARKS)

Explain one core making process belonging to the self-set chemical bonded system. Your answer should include:

4.1. The name of the process (1)

4.2. The resin (2)

4.3. The catalyst (2)

4.4. Typical addition rates of resin and catalyst (2)

4.5. Typical bench time (2)

4.6. Core making steps (4)

4.7. The type of mixing equipment (2)