



PROGRAM : NATIONAL DIPLOMA
ENGINEERING METALLURGY

SUBJECT : **FOUNDRY TECHNOLOGY II**

CODE : **FTY21-1**

DATE : SSA EXAMINATION
19 JULY 2018

DURATION : (Z-PAPER) 15:00 – 18:00

WEIGHT : 40: 60

TOTAL MARKS : 105

FULL MARKS : 100

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 (45 MARKS)

The input and outputs flows of a greensand mullor are schematically shown in Figure 1. The mullor supplies two automatic high-pressure *squeeze*-moulding machines. One moulding machine is dedicated for the production of copes while the other machine is for the production of drags. The cope and the drag are assembled at a rate of 250 complete moulds/hour. The moulding machines have the following characteristics:

- Flask dimensions: 600 X 400 X 110 mm³
- Weight of the greensand for the cope: 35 kg
- Weight of the greensand to produce the drag: 40 kg
- Average casting weight in the mould: 13.6 kg
- Density of casting: 7.8 kg/m³

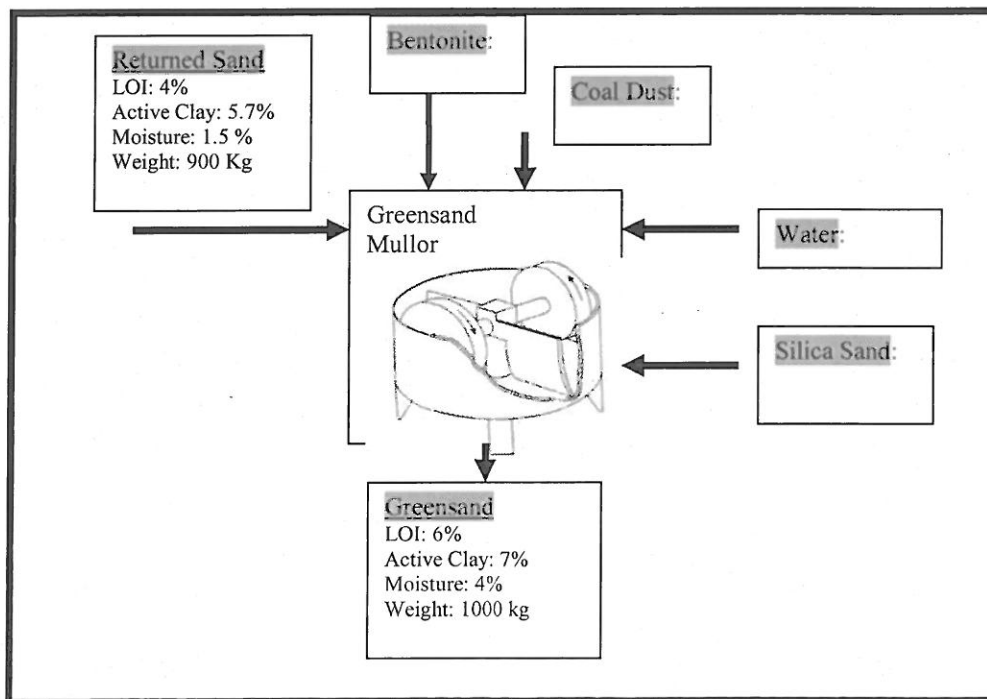


Figure 1. Additions of raw materials around a greensand mullor

1.1 Determine the following:

1.1.1.1 The monthly requirements of greensand raw materials: bentonite, coaldust and silica sand for this foundry. Consider that a month has 20 working days and a working day has 8 hours. Show all the calculation steps (10)

1.1.2 The burn-off of bentonite and carbonaceous material applicable in the foundries. (5)

1.1.3 If the casting weight is reduced from 13.6 kg to 9.8 Kg, predicts and justify the variation of the following greensand properties:

1.1.3.1 Compactibility (2.5)

1.1.3.2 Greenstrenght (2.5)

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

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

1.2.2 Explain two possible problems of the density profile of moulds with regards to the soundness of the castings (5)

1.2.3 Explain the two functions of a typical moulding machine (4)

1.2.4 Give and explain the function of coaldust in greensand (5)

1.3 The cope and drag are coated with graphite water based paint prior to mould assembly. List and explain the components and functions in such a coating. (5)

QUESTION 2 (35 MARKS)

A foundry operates a coreless induction furnace lined with a silica refractory material. The capacity of the melting furnace is 5 tons. The foundry produces two heats per days. The melting characteristics of raw materials available for the furnace charge are listed 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	Remainder	-	3.2	2.0	0.6	0.1	0.2	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 (20 days) cost of graphite, FeSi and FeMn addition to produce a grade 200 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 200

C	Si	Mn	S	P
3.2-3.4%	2.0-2.5%	0.6-0.8%	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 List and explain three advantages of coreless induction melting furnaces (6)

2.3 Explain two reasons why silica refractory is a suitable refractory lining for the melting of gray iron. (4)

2.4 Fully explain how the grey iron cast alloy structure is achieved.

(10)

QUESTION 3 (10 MARKS)

Write short notes on the application of the *4th Industrial Revolution* to Metal Casting. In your answer, include the following points:

- 3.1. Example of 4th Industrial Revolution technology applied to metal casting (2)
 - 3.2. Example of applications (4)
 - 3.3. Benefits/ advantages for the metal casting (4)
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QUESTION 4 (15 MARKS)

Explain one core making process of your choice belonging to the gas-triggered 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. Two advantages (2)
 - 4.6. Core making steps (4)
 - 4.7. The type of mixing equipment (2)
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