



**UNIVERSITY OF GHANA**

(All rights reserved)

**BSc. (ENG) MATERIALS SCIENCE AND ENGINEERING**

**END OF FIRST SEMESTER EXAMINATIONS: 2016/2017**

**MATERIALS SCIENCE AND ENGINEERING DEPARTMENT**

**MTEN 413: FOUNDRY TECHNOLOGY (2 CREDITS)**

**TIME ALLOWED: 2 HOURS**

**Answer ALL Questions**

1.

a) Define the following terms

[10 marks]

- i) Skim core
- ii) Skim bob
- iii) Stepgate
- iv) Splash core
- v) Directional solidification

b) During pouring of molten metal, pouring errors can occur. List and explain them.

[6 marks]

c) Gases that are not allowed to escape before solidification may cause porosity in metals. What are the sources of these gases?

[3 marks]

d) How will you control dissolved hydrogen gas?

[6 marks]

2.

a) The use of a riser is very important in foundry technology. An aluminium item of dimensions 40 inches  $\times$  5 inches  $\times$  10 inches has been designed and using the three riser types as shown in Figure 2, which type(s) will be suitable for the casting. Using height (h) = diameter (d) condition and solidification shrinkage (S) = 6%. [11 marks]

b) You have been consulted to cast an item of dimensions 5 inches  $\times$  5 inches  $\times$  140 inches. Using the top riser formula for a riser with  $h = 2d$ , calculate;

i) the end effect (EE) and riser effect (RE). [4 marks]

ii) the farthest distance for a sound cast. [2 marks]

iii) each riser feeding distance for a sound cast. [2 marks]

iv) the number of risers for a sound cast. [6 marks]

3.

Describe the following casting processes; [25 marks]

a) Centrifugal casting.

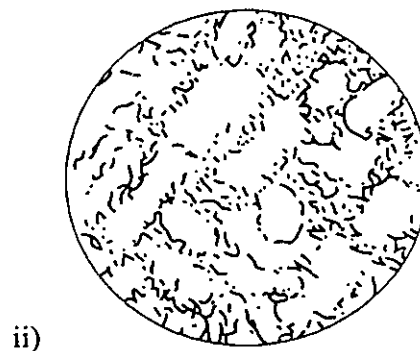
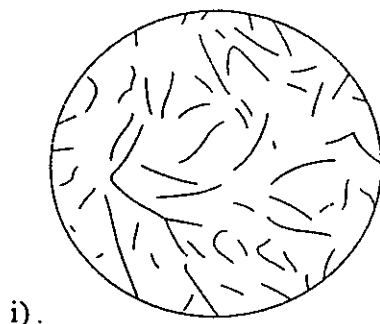
b) Die casting.

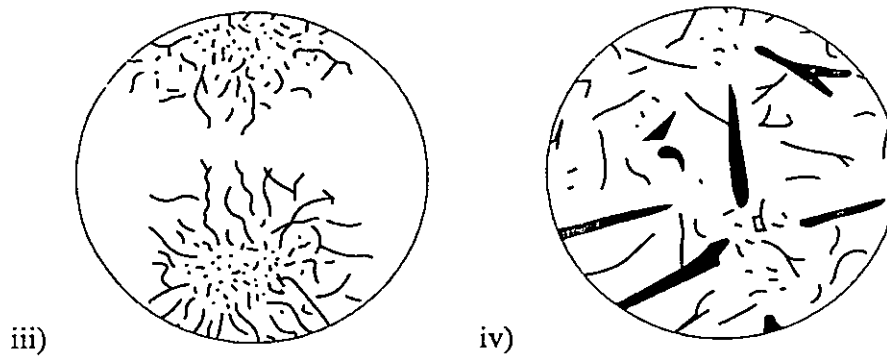
c) Investment casting.

d) Shell moulding casting.

4.

a) Identify the following microstructures under cast iron in Figure 1.





**Figure 1:** The graphite morphology.

[4 marks]

b) List the types of cast iron used to produce cast items as discussed. [5 marks]

c) Explain the melting practice, magnesium treatment and inoculation of ductile iron.

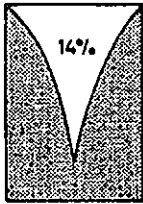
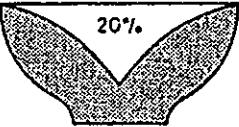
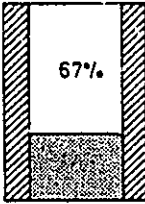
[6 marks]

d) Distinguish between homogenous and heterogenous nucleation.

[4 marks]

e) The production of components using casting has certain advantages over other forming methods. Give four reasons for this statement.

[6 marks]

Head design			
Ratio of shrinkage $V_S$ to initial volume $V_F$	$V_S = 0.14 V_F$	$V_S = 0.20 V_F$	$V_S = 0.67 V_F$
Factor (approx)	7	5	1.5

**Figure 2:** Utilisation of risers.