



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering (Hons) Degree Industrial and Manufacturing Engineering

MANUFACTURING PROCESSES I

TIE 3113

FIRST SEMESTER SUPPLEMENTARY EXAMINATION

AUGUST 2015

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Nil

Examiner's Name: Eng. M. Makhurane

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Answer any five (5) questions
2. Each question carries 20 marks

MARK ALLOCATION

MARKS	QUESTION
20	1.
20	2.
20	3.
20	4.
20	5.
20	6
20	7
100	TOTAL

QUESTION 1

Make a neat sketch of a cupola furnace, indicating its various zones and describe the following: [12]

- | | | |
|------|--------------------------------|-----|
| i) | Preparation before operations, | [2] |
| ii) | Operation, | [2] |
| iii) | Advantages, | [2] |
| iv) | Application. | [2] |

QUESTION 2

- What are crucible furnaces? Where are they preferred and why? [8]
- Molten metal can be poured into the pouring cup of a sand mold at a steady rate of $1000\text{cm}^3/\text{s}$. The molten metal overflows the pouring cup and flows into the downsprue. The cross-section of the sprue is round, with a diameter of 3.4 cm at the top. If the sprue is 25cm long, determine the proper diameter at its base so as to maintain the same volume flow rate. [12]

QUESTION 3

- a) Use Bernouli Theorem to show that $v = \sqrt{2gh}$ [8]
- b) Use diagrams to illustrate the five (5) steps in Vacuum Molding [12]

QUESTION 4

- a) Label the sketch in Fig Q4 explaining the sequence of processes that it illustrates. [12]

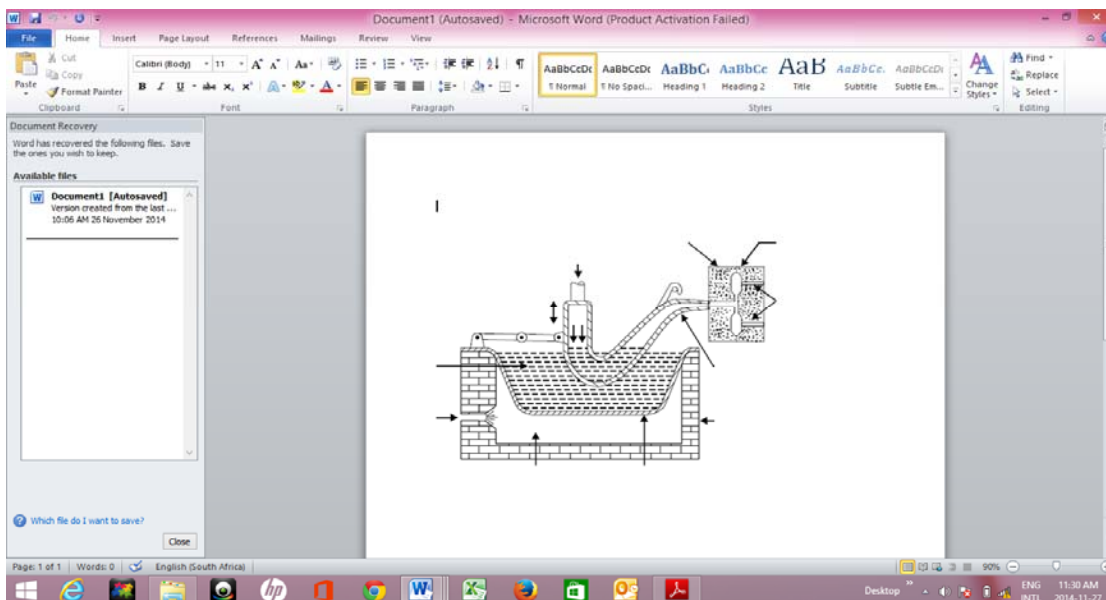


Fig. Q4 : Manufacturing Process

- b) List any two possible causes and remedies for the following casting defects
- i. Blow Hole, [2]
 - ii. Pinhole, [2]
 - iii. Misrun, [2]
 - iv. Porosity. [2]

QUESTION 5

In casting experiments performed using a certain alloy and type of sand mould, it took 155s for a cube-shaped casting to solidify. The cube was 50 mm on a side.

- a) Determine the value of the mould constant in Chvorinov's rule [8]
- b) If the same alloy and mould type were used, find the total solidification time for a cylindrical casting in which the diameter is 30 mm and length is 50 mm. [12]

QUESTION 6

- c) Using the neat sketches, describe procedural steps to be followed in making dry sand mold. [8]
- d) Explain and illustrate the rotational moulding cycle performed on a three station indexing machine [12]

QUESTION 7

- a) A cylindrical riser must be designed for a sand-casting mold. The casting itself is a steel rectangular plate with dimensions 7.5 cm by 12.5 cm by 2.0 cm. Previous observations have indicated that the total solidification time (T_{TS}) for this casting is 1.6 min. The cylinder for the riser will have a diameter-to-height ratio of 1.0. Determine the dimensions of the riser so that its Total Solidification Time is 2.0 min. [5]
- b) Draw and explain the operation of a Copula Furnace. [15]