NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF TECHNICAL TEACHER EDUCATION

Programme: BACHELOR OF EDUCATION HONOURS DEGREE

Course:	Manufacturing Processes	TTE 3246
Part/year:	III	May 2010
Time:	3 hours	100 marks

Instructions
1. Examination length is **3hrs**.
2. Each question carries twenty (**20**) marks and there are six (**6**) questions in total.
3. Attempt the whole of Section A and three questions from Section B.

Section A

Question 1

a)   Briefly discuss the limitations of sand casting.

[6]

b)   Outline the continuous casting of steel, using illustrations where appropriate.   **[14]**

Question 2

a)   Draw two sketches showing the basic difference between impression-die and closed-die forging.   **[6]**

b)   Make illustrations showing the essential features of

i)   Forward extrusion.   **[3]**

ii)   Reverse extrusion.   **[3]**

c)   List various operations generally performed in a sheet metal shop.   **[8]**

Section B

Question 3

a) Explain any four types of defects that occur during sheet metalworking processes.

[8]

b) You are given the following data for a bending operation.

L1 = 25mm   R1 = 8mm α_1 = 30t = 3mm
L2 = 50mm   R2 = 10mm α_2 = 120
L3 = 15mm   R3 = 10mm α_3 = 90
L4 = 10mm

i) Sketch this shape. **[4]**
ii) What is the total length of the strip needed to make the shape? **[4]**
iii) Find the engineering strain and the true strain in the outer fibre at the bend, where R = 8mm. **[4]**

Question 4

A square bar, 5 mm x 5 mm in cross section and 100 mm long is to be flattened into a section that is only 2 mm thick and remains 100 mm in length. The press velocity is 2 m/min. The coefficient of friction is 0.10, with a lubricant. Strength coefficient in cold working is 620 MPa and in hot working is 120 MPa, strain hardening exponent n is 0.18, and strain rate sensitivity m is 0.10 at 1000^oC.

a) Make a sketch of the bar before and after deformation. **[4]**
b) Determine
i) Engineering strain in the height direction. **[2]**
ii) True strain in the height direction. **[2]**
iii) True strain rate. **[2]**
iv) Mean flow stress. **[2]**
v) Flow stress if the part is formed at 1000^oC. **[2]**
vi) Deformation force at 1000^oC. **[3]**
vii) Power required for deformation at 1000^oC. **[3]**

Question 5

In an interview for a foundry job in Shanghai, China, you are asked to describe, briefly, the essential features of the two high pressure die casting processes. Clarify the method of filling the cavity.

[20]

Question 6

a) Define castability. **[2]**
b) Why are steels more difficult to cast than cast irons? **[2]**
c) What are the differences in the properties of castings made by permanent mould compared to sand casting methods? Explain. **[6]**
d) State the most important factors in casting processes. **[4]**
e) Turbulence is undesirable in melt flow in gating systems. Explain why and how it can be minimised. **[6]**

END OF EXAMINATION