



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 2 Examination in Engineering: March 2014

Module Number: ME2302

Module Name: Introduction to Materials Science and Manufacturing Engineering

[Three Hours]

[Answer all questions]

Part A

(Q1 carries 5 marks, Q2 & Q3 carry 10 marks each)

- Q1. a) Explain with a neat sketch, the working principle of radial drilling machine. [2.0 Marks]
- b) With simple sketches explain the following machining operations. [2.0 Marks]
- I. Boring
 - II. Reaming
- c) State the main differences between "shaper" and "planer" [1.0 Mark]
- Q2. a) Why split patterns are used in sand casting? Briefly explain with a suitable example [2.0 Marks]
- b) Briefly explain six different types of casting defects. [3.0 Marks]
- c) Describe the disadvantages to have a "riser" that is, [2.0 Marks]
- I. too large
 - II. too small
- d) The blank for the spool shown in Figure Q2 is to be sand cast out of an aluminum alloy. Make a sketch of the wooden pattern for this part, and show all necessary steps in preparing the mould. [3.0 Marks]

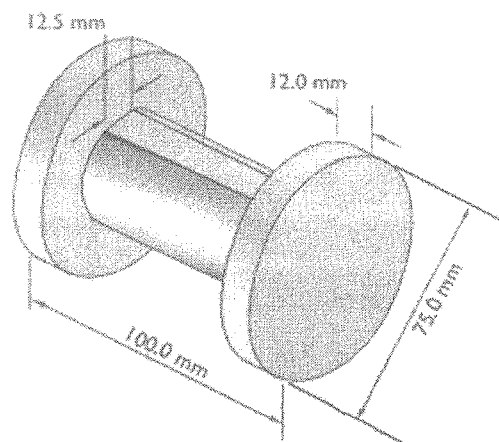


Figure Q2

- Q3. a) List three safety precautions to observe when milling. [2.5 Marks]
- b) I. List the different types of milling machines.
II. With a neat sketch explain universal milling machine. [2.5 Marks]
- c) What is indexing in milling operation? [2.5 Marks]
- d) Draw free hand sketches of five different types of milling cutters. [2.5 Marks]

Part B

(Q4 & Q5 carry 10 marks each, Q6 carries 05 marks)

- Q4. a) Draw the phase diagram for a system of two components which are soluble in each other in all proportions in both liquid and solid states and indicate the solidus line(S), Liquidus line (L), The melting temperatures (T_1 and T_2) of the pure elements on the diagram. [2.0 Marks]
- b) Derive the Lever rule for the amount in weight percent of each phase in two-phase region of a binary phase diagram. Use the phase diagram drawn in Q4 (a). [2.0 Marks]
- c) A phase diagram of Sn -Pb binary system is shown in the Figure Q4 (c). Consider a point at 40 wt% Sn – 60 wt% Pb alloy at 150 °C.
I What are the phases present
II What are the compositions of the phases present?
III What are the Mass fractions of each phase? [6.0 Marks]
- Q5. Consider a FCC structured metallic material
- a) Draw the unit cell of this metallic material and mark following planes on it.
I Plane (110)
II Plane (111)
III Plane (100) [3.0 Marks]
- b) Calculate the Linear density of the plane (210) [2.5 Marks]
- c) Calculate the planer density of the plane(111) [2.5 Marks]
- d) What are the uses of calculating planer density and linear density of Metallic materials? [2.0 Marks]
- Q6. a) What is a composite material?
b) Give examples for composites applied in Civil, Electrical and Mechanical engineering sectors. [5.0 Marks]

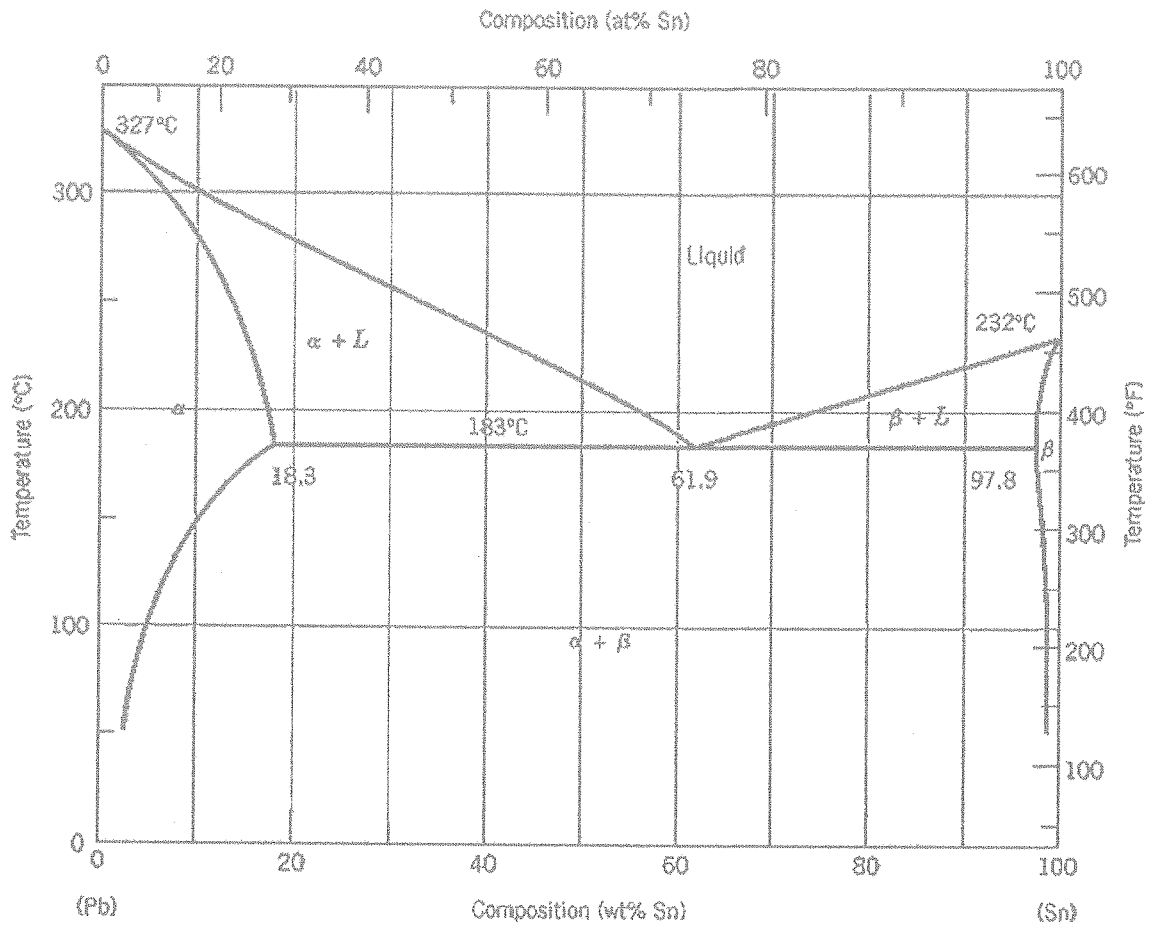


Figure Q4 (c)