The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Diploma in Technology/Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX5272 –Materials and Manufacturing Technology**
Academic Year	:	2012/13
Date	:	**22nd August 2013**
Time	:	**0930-1230 HRS**
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 8 questions. All questions carry equal marks.
3. Answer **any 5** questions only.
4. Iron–carbon phase diagram is provided at the end of the question paper

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Q1. (a) Label the phases present in each region in the given Iron –carbon phase diagram. (Phase diagram is attached at the end of the question paper)

(b) Identify and describe all invariant reactions found in the diagram.

(c) Using lever rule, calculate the amount of phase present just above the eutectoid temperature for steel containing 0.5 wt % carbon.

Q2. Using the isothermal transformation diagram in Figure (2) below , for a 1.13 wt% C steel alloy determine the final microstructure of a small specimen that has been subjected to the following time-temperature treatments. Assume that the specimen begins at 920^0C and that it has been held at this temperature long enough to have achieved a complete and homogeneous austenitic structure.

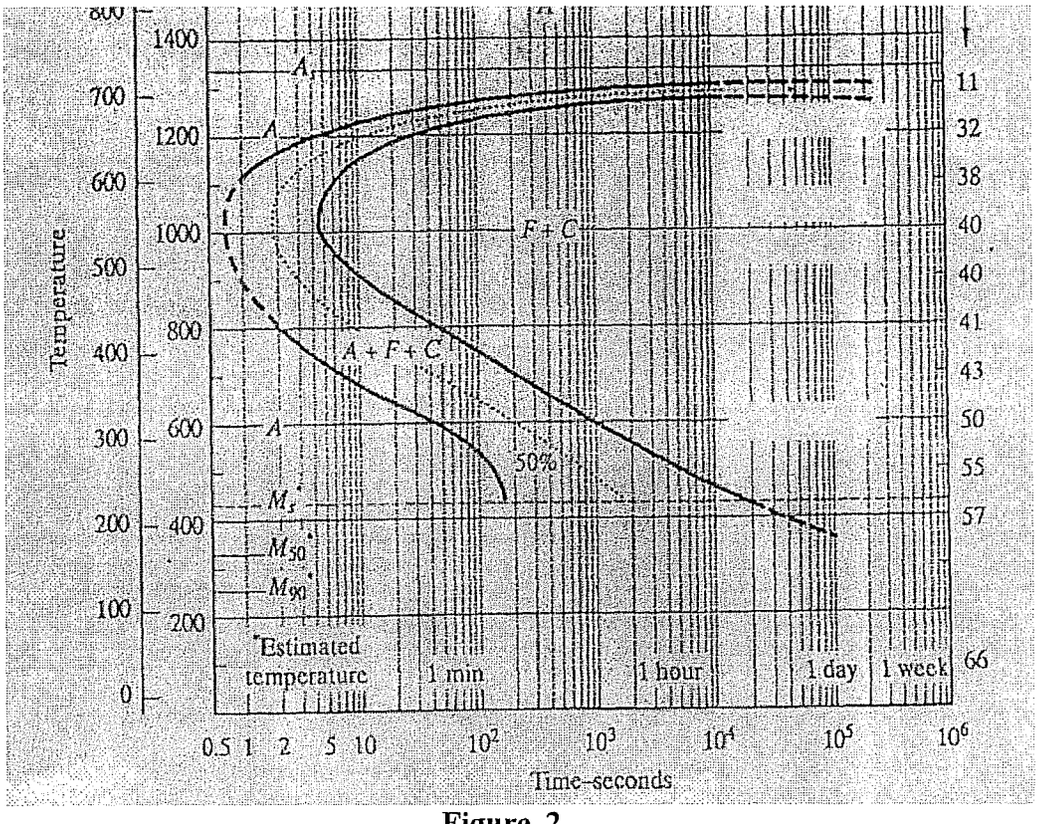


Figure 2

(a) Rapidly cooling to 420^{0}C, holding for 10secs, and then quenching to room temperature.

(b) Rapidly cooling to 650^{0}C, holding at this temperature for 10secs, rapidly cool to 450^{0}C and holding for 10secs and then quenching to room temperature.

(c) Determine the requirements (time Temperature paths) to produce following microstructures.
   (i) 100% fine pearlite
   (ii) minimum cooling rate to form 100% Martensite.

Q3. Discuss and analyze any **three** of the following topics.

(a) Types of stainless steel
(b) Difference between Thermoplastics and Thermosetting plastics
(c) Hardenability of steel
(d) Various effects of alloying elements in steel
(e) Difference between solid solution strengthening and precipitation strengthening

Q4. (a) Metrology plays a vital role in manufacturing of components. Discuss the significance of metrology in the field of Manufacturing Technology.

(b) Resolution and sensitivity are two characteristics often considered when selecting a measuring instrument for a particular job.Taking an example, explain the terms 'resolution' and 'sensitivity' with respect to measuring devices.

(c) In manufacturing industry, comparators are utilized to make measurements of components.
(i) What is a comparator?
(ii) Discuss the pros and cons of mechanical comparators over other types of comparators.

Q5. (a) Define the term 'tolerance' in relation to manufacturing of components. Discuss four (04) reasons for setting tolerances during a manufacturing process.

(b) Distinguish geometrical tolerance from dimensional tolerance. Elaborate on your answer by the way in which these tolerances are specified.

(c) What are the two systems available for obtaining a class of a fit? Explain them briefly by giving suitable examples.

Q6. (a) What is meant by 'solid-state' welding? Discuss the advantages of solid state welding over other welding processes.

(b) Compare and contrast between non-consumable and consumable electrode type arc welding processes. Give two (02) examples each for the above two types of welding processes.

(c) Explain the process of explosion welding and state its applications and limitations.

Q7. (a) Discuss the advantages of forming processes over other manufacturing processes. Name four (04) forming processes commonly used in manufacturing of components.

(b) Describe the phenomena of cold working and hot working in metal forming processes and discuss their effects on the strength and ductility of metals.

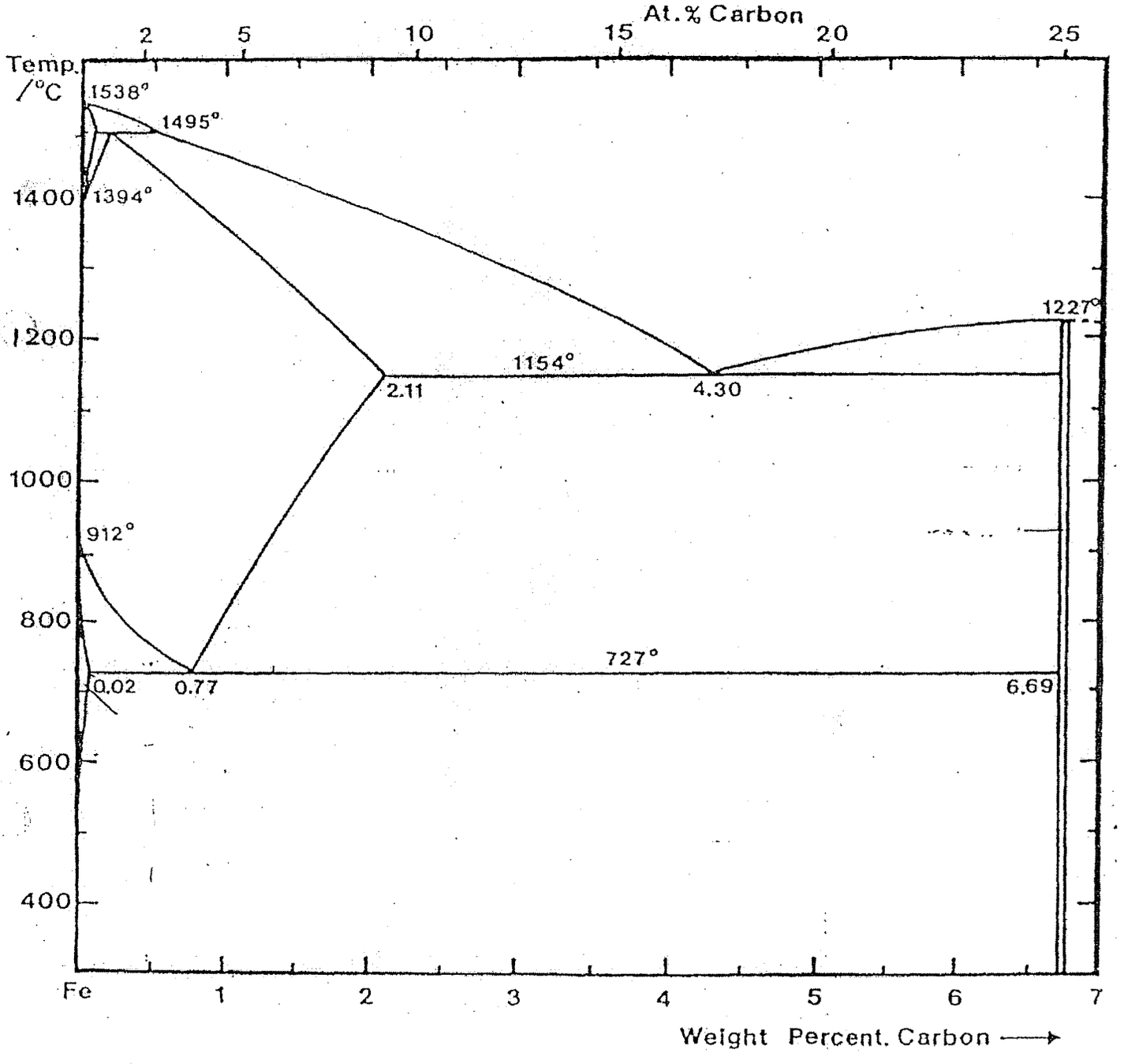
(c) How would you distinguish bulk deformation processes from sheet metal processes in relation to metal forming processes? Briefly explain the forming operations that need to be carried out when producing a Coke can.

Q8. (a) Discuss taking suitable examples, the classification of metal cutting processes. State the basis on which the above classification is made.

(b) Understanding about chip formation during machining plays a significant role in analyzing metal cutting and designing of machine tools. Explain.

(c) Define the terms 'Material removal rate (*MRR*)' and 'Specific cutting energy (*u*)' with respect to machining operations. Show that the cutting power is the product of *MRR* and *u*.

End



Iron Carbon Phase diagram