The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX5272 –Materials and Manufacturing Technology**
Academic Year	:	2014/15
Date	:	**20th September 2015**
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.

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1. (a) With the aid of sketches, briefly explain complete solid solubility and partial solid solubility in alloys.

   (b) A phase diagram of Magnesium-Lead is shown in Fig.(1) given at the end of the paper.

   (i) Label the phase/s in areas 1-6 and name the reaction which occurs at point E. **(Remember to attach the phase diagram with the answer script)**
   (ii) Considering an alloy containing Pb-50 wt% and Mg-50 wt% state the phase changes that occur when cooling from 700^0C to 0^0C.
   (iii) Calculate the amounts of liquid and solid present at temperature 500^0C for the above alloy.

2. (a) Briefly explain the difference between hardness and hardenability.

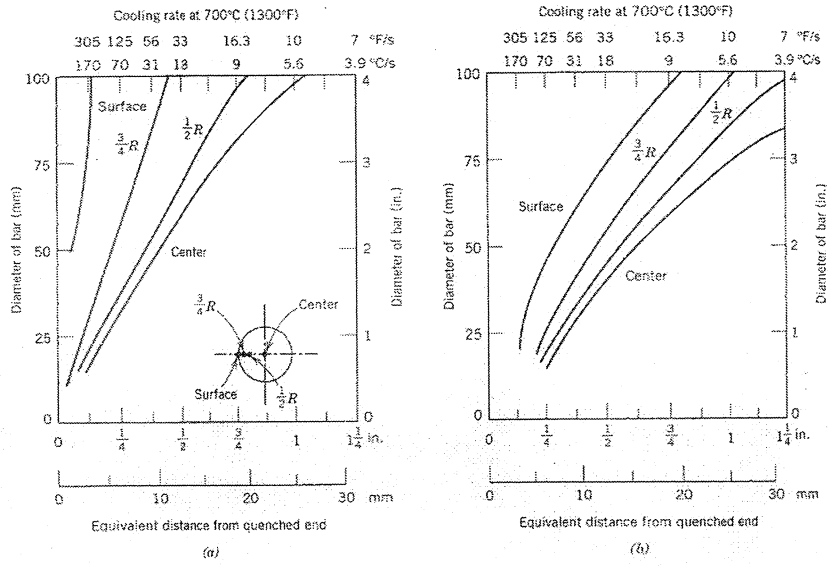
   (b) A cylindrical piece of steel 38 mm in diameter is to be austenized and quenched such that a minimum hardness of 45 HRC is to be produced throughout the entire piece. Of the alloys 8660, 8640, 8630, and 8620, which will qualify if the quenching medium is,

   (i) moderately agitated water

   (ii) moderately agitated oil.

   Justify your choice/s.

Refer Fig.2 (a) & Fig.2 (b) to find out the equivalent jominy positions and related hardenability values.



(i) moderately agitated water (ii) moderately agitated oil

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Fig. 2 (a)

Fig.2(a) – Cooling rate as a function of diameter at surface, three-quarter radius (3/4R), mid radius (1/2R) and center positions for cylindrical bars quenched in moderately agitated (i) water and (ii) oil. Equivalent jominy positions are included in bottom axis.

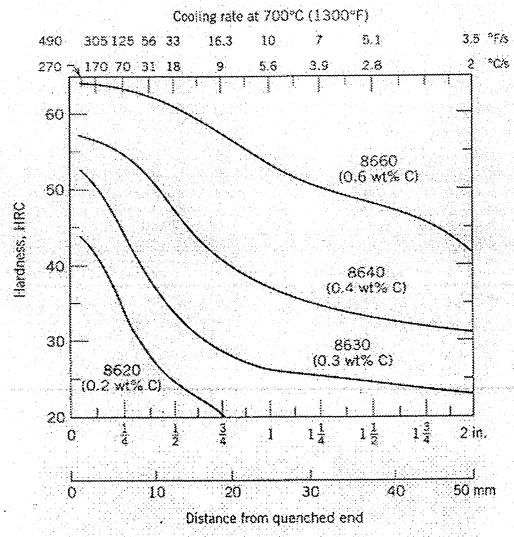


Fig.2(b) –Hardenability curves for four 8600 series alloys

3. Discuss and analyze the significance of any **three** of the following from an Engineering point of view.

   (a) Grain boundary strengthening mechanism of materials.
   (b) Time –Temperature-Transformation curves.
   (c) Difference between Thermoplastics and Thermosetting plastics and their applications.
   (d) Compare and contrast gray cast iron and nodular cast iron.
   (e) Categories of plain carbon steels and their properties.

4. (a) Explain the term **welding** with respect to joining processes. State the advantages of welding processes over other joining processes.

   (b) Define the following terms with respect to welding.

   (i) Weldment.

   (ii) Faying surfaces.

   (iii)Coalescence.

   (c) Why is it extremely important to have the surfaces to be weld, thoroughly cleaned in solid-state welding processes?

5. (a) Discuss the importance of **Metrology** in manufacturing of products.

   (b) Explain the factors that have to be taken into consideration when selecting a measuring instrument for a particular job in manufacturing. Justify your answer with a suitable example.

   (c) Elaborate on the four most common types of errors which can occur when taking a measurement using a measuring instrument. Explain the way in which you can minimize these errors.

6. (a) How are material removal processes classified? Give examples for each of the classified types of material removal processes.

   (b) Grinding is one of the most common abrasive process. State and explain two other abrasive processes employed in the manufacturing industry.

   (c) What are important cutting tool geometries of a single pointed cutting tool? Illustrate these on a neatly drawn sketch.

7. (a) Describe the term 'permeability' in the context of a molding sand and explain the importance of permeability in sand casting.

   (b) What are the criteria that need to be satisfied, in selecting sand for a molding?

   (c) List out and explain three common types of casting defects that would occur in improper casting processes.

8. (a) Briefly discuss role of Mechatronics in the modern manufacturing environment.

   (b) Various control technologies could be adapted in enhancing machining operations. Explain how it could be done.

   (c) Discuss the applicability of hard automating and soft automation in manufacturing industry.

Attach the phase diagram with the answer script.

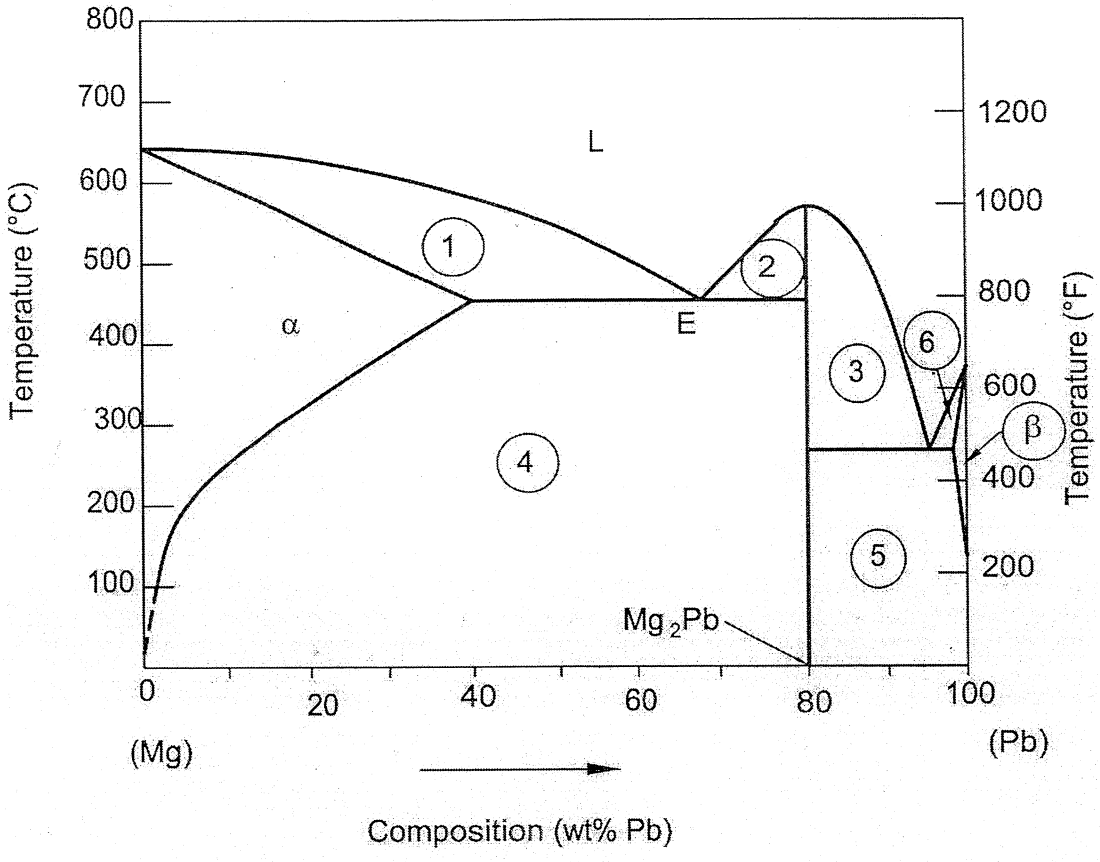


Fig.(1)

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