



**KIBABII UNIVERSITY  
(KIBU)**

**UNIVERSITY EXAMINATIONS  
2020/2021 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER MAIN EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE IN PHYSICS**

**COURSE CODE: SPM 322**

**COURSE TITLE: STRUCTURAL CHANGES**

**DATE: 8/10/2021**

**TIME: 2:00-4:00PM**

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**INSTRUCTIONS TO CANDIDATES**

TIME: 2 Hours

Answer question ONE and any TWO of the remaining.

Symbols used bear the usual meaning.

KIBU observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over. ►

**QUESTION ONE (30 MARKS)**

- a) State four forms in which an alloy can exist in solid state (4 marks)
- b) State the meaning of the following terms commonly used in solid phases and Phase diagrams (i) System (ii) Components (iii) Phase (iv) Phase transformation (4 marks)
- c) Outline briefly the basic principles of a Resin Transfer Moulding (RTM) in the context of design and production of Fibre reinforced plastic artifacts (5 marks)
- d) Describe the difference between cold and Hot working as relates to material fabrication (2 marks)
- e) State three factors that govern the structure of an intermediate phase (3 marks)
- f) Describe the Hume-Rothery's rules of formation of a solid solution (3 marks)
- g) Briefly explain the meaning of surface integrity in relation to manufactured surfaces and their properties and applications (2 marks)
- h) Describe the different types of solutions in solid state (i) Simple Eutectic type (ii) Solid solution type (iii) Combination type (iv) Inter-metallic Compounds (4 marks)
- i) Describe the Gibbs phase rule stating the components involved (3 marks)

**QUESTION TWO (20 MARKS)**

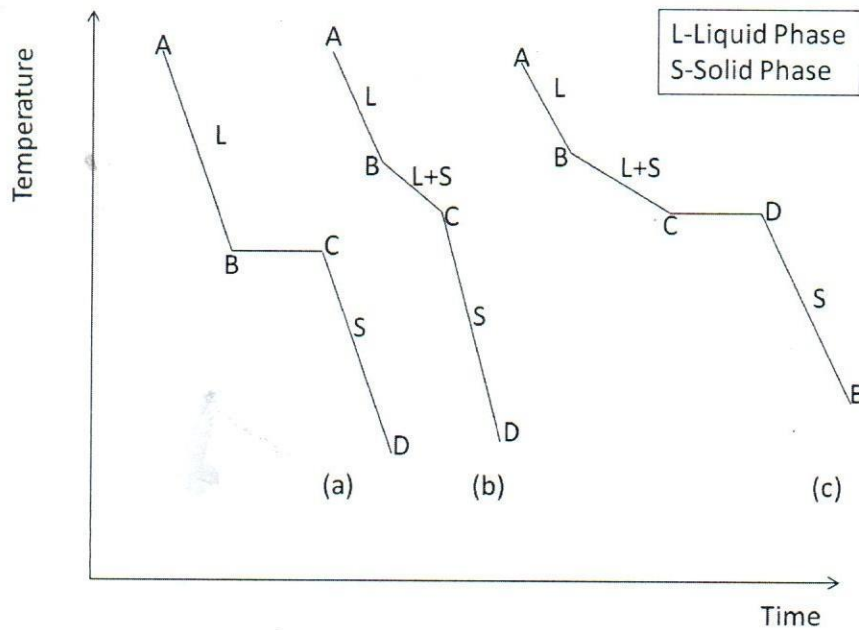
- a) Discuss the Recovery, Recrystallization and Grain growth phenomenon in a deformed material (9 marks)
- b) Discuss the formation of a solid solution specifying the two main types (6 marks)
- c) Describe any five engineering alloys commonly used (5 marks)

**QUESTION THREE (20 MARKS)**

- a) Discuss the Czochralski silicon growth process with an aid of a schematic diagram describing the steps involved to get the final pure Silicon (12 marks)
- b) Discuss the Gas Phase synthesis process of fabricating Silicon carbide on a substrate showing essential reaction steps (8 marks)

**QUESTION FOUR (20 MARKS)**

- a) Discuss the cooling curves shown in the diagram below indicating the nature of material and phase transitions involved in each segment (12 marks)



- b) Discuss the effect of slow and rapid cooling curves with illustrations for a pure metal with reference to the concept of recalescence. (8 marks)

**QUESTION FIVE (20 MARKS)**

- a) In conventional metal cutting process tool wear is inevitable, discuss the most significant factors causing tool wear and explain why tool wear is difficult to predict (8 marks)
- b) Describe four different methods that can be used for on-line monitoring of tool wear, indicating the possible problems associated with each method and justify the method that you consider to show most promise (12 marks)