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(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
EXAMINATIONS FOR THE DIPLOMA
IN
MECHANICAL AND INDUSTRIAL ENGINEERING

COURSE CODE: DME 063

COURSE TITLE: MATERIALS AND METALLURGY II

DATE: 22/04/2022 **TIME:** 8:00-10:00 AM

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other **TWO** questions

TIME: 2 Hours

QUESTION ONE **(30MKS)**

a) Differentiate between dry and wet Corrosion **(2mks)**

i) Highlight FIVE types of Corrosion **(5mks)**

ii) Differentiate between Anodic and Cathodic inhibitors **(3mks)**

b) Discuss different types of heat treatment methods **(10mks)**

c) Define a Furnace **(2mks)**

i) State THREE typical Furnace Systems that do exist in the modern industries **(3mks)**

ii) State FIVE typical energy efficiency measures for an Industry with Furnace **(5mks)**

QUESTION TWO **(20MKS)**

a) With the aid of sketches describe the following heat treatment furnaces giving TWO advantages and TWO limitations in each case
   i) Muffle furnace (gas heated)
   ii) Muffle furnace (electric resistance) **(10mks)**

b) Describe the following types of carburizing heat treatment
   i) Liquid Carburizing
   ii) Gas Carburizing
   iii) Pack Carburizing **(10mks)**

QUESTION THREE **(20MKS)**

a) Explain the following constituents of iron and steels
   i) Ferrite
   ii) Austenite **(6mks)**

b) Describe the following with regard to strengthening mechanism in metals
   i) Strain hardening
   ii) Solid solution strengthening
   iii) Strengthening by grain size reduction **(9mks)**

c) Define the following terms as applied to cooling curves for pure metals
   i) Undercooling
   ii) Recalescence
   iii) Thermal arrest
   iv) Total solidification time
   v) Local solidification time **(5mks)**

QUESTION FOUR **(20MKS)**

a) Describe using a well labelled diagram Lead Tin Partial solubility phase diagram **(8mks)**

b) Define the following terms
   i) Phase transformation
   ii) Solubility limit
   iii) Solid solution **(3mks)**

c) Distinguish between the following types of phase diagrams
   i) Binary phase diagram
   ii) Unary phase diagram **(4mks)**

d) Explain the following corrosion accelerated by mechanical stresses
   i) Fatigue corrosion
   ii) Stress corrosion **(5mks)**