50

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS 2020/2021 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN PHYSICS

COURSE CODE: SPH 261

COURSE TITLE: APPROPRIATE TECHNOLOGY I

DATE: WEDNESDAY 27TH APRIL, 2022 **TIME:** 3:00 PM – 5:00 PM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining.
Symbols used bear the usual meaning.

MMUST observes ZERO tolerance to examination cheating

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

QUESTION ONE (30 MARKS)

(a) State five basic needs that can be fulfilled by use of appropriate and sustainable technologies **(5 marks)**

(b) Explain the two types of risks that are considered in appropriate technological designs **(4 marks)**

(c) Define smart technological growth and explain its consequence in determining the appropriateness of technology **(4 marks)**

(d) Describe four elements that can be used to define appropriateness of technology **(8 marks)**

(e) Define derating factor and explain its importance in critical technological designs **(4 marks)**

(f) In a multivariable system the velocity can change from $400ms^{-1}$ to $500ms^{-1}$ and the temperature can vary from 20° C to 80°C. Calculate the level of dependency of velocity to temperature if the temperature varies from 20° C to 60°C as the velocity changes from $400ms^{-1}$ to $500ms^{-1}$ **(5 marks)**

QUESTION TWO (20 MARKS)

(a) Explain the main design considerations in the thermal management of systems that are operated at temperatures near maximum ratings. **(8 marks)**

(b) Explain the role of appropriate technology in contribution to the betterment of life in the developing world. **(12 marks)**

QUESTION THREE (20 MARKS)

(a) Explain the basic processes that determine the quality of a system or product **(8 marks)**

(b) Discuss the major challenges in designing appropriate technologies. **(12 marks)**

QUESTION FOUR (20 MARKS)

(a) Outline key methods applied in appropriate technology to ensure designs that are fault tolerant. **(8 marks)**

(b) Discuss criteria for determination of appropriate technologies regarding their environmental impact and location. **(12 marks)**

QUESTION FIVE (20 MARKS)

(a) Determine the worst-case values in a feedback system defined by:

$$A_f = \frac{A_o \sin(\omega t)}{1 + BA_o}$$

where $A_o = 100 \pm 9.9$ and $B = 5 \pm 0.9$ and $\pi/5 < \omega t < 7\pi/4$ **(6 marks)**

(b) Describe the steps to follow in performance of a risk assessment when an out of specification (ALERT) condition is encountered in design of appropriate technologies. **(14 marks)**