MACHAKOS UNIVERSITY

Supplementary University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION (SCIENCE)

SPH 441: MICROPROCESSOR APPLICATIONS AND SYSTERMS

DATE: 25/7/2019 **TIME: 2:00 – 4:00 PM**

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

SECTION A (COMPULSORY)
QUESTION ONE

a) i. By use of a digital circuit diagram, distinguish between a sequential and combinational circuit. (3 marks)
ii. State the two examples of transducers (1 mark)
iii. Briefly explain the need for an analogue-to digital converter (ADC) microprocessor-based systems (2 marks)

b) Give the measurable physical quantities in the following energy types: (2 marks)
i. Mechanical
ii. Thermal
iii. Electrical
iv. Magnetic

c) i. State three useful applications of Micro-Electro-Mechanical Systems (MEMS) (3 marks)
ii. Outline two characteristics of typical analog systems (2 marks)

d) Implement a 3-pin truth table for the following circuits (6 marks)
   i. EXOR gate
   ii. NAND gate
   iii. EXNOR gate

e) State any two examples of (2 marks)

f) Convert $(0.6875)_{10}$ into octal (3 marks)

g) i. List two types of Analogue to Digital converters (2 marks)
   ii. Outline two types of Digital to Analogue converters (2 marks)

h) i. Differentiate between low-level and high-level programming languages (2 marks)
   ii. State one merit and one demerit of machine code compared to a high-level language (2 marks)

QUESTION TWO

a) State any three advantages of the fiber optics sensor (3 marks)

b) With illustrations, discuss the major types of proximity sensors (6 marks)

c) Use a diagram to explain the principle of operation of a thermistor as a transducer for temperature (5 marks)

d) Depending upon function, infrared sensors are grouped as thermal and quantum. What are the differences between these two types? (6 marks)

QUESTION THREE

a) Draw a block diagram of a typical 8-bit microcomputer and discuss the functions of the following components: (12 marks)
   i) the buses
   ii. central processing unit
   iii. the memory

b) Differentiate between a random access memory (RAM) and a read only memory (ROM) (4 marks)

c) Use a diagram to explain the WRITE operation of a random access memory (4 marks)

QUESTION FOUR

a) Convert the following binary numbers into decimal without the use of a calculator: (12 marks)
   a) 1101
   b) 111000
   c) 1001101
   d) 1011010

b) Convert the following hexadecimal numbers to (i) binary (ii) decimal and (iii) octal: (8 marks)
   (a) 34_{16}
   (b) $1A1_{16}$
   (c) DB_{16}

QUESTION FIVE

a) Rotary encoders are divided into two, namely incremental and absolute. Discuss, with the aid of diagrams, these encoders in terms of their:

i. Differences (5 marks)

ii. Applications (5 marks)

b) Light Dependent Resistor, LDR, are used in street lamps, camera light meters, alarm clock, burglar alarm circuits, light intensity meters, and counting packages moving on a conveyor belt. Explain how LDR are used in:

i) Street lamps, (2 marks)

ii) Camera 2 marks)

iii) Light meters (2 marks)

iv) Burglar alarm circuits (2 marks)

v) Counting packages moving on a conveyor belt (2 marks)