



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF
EDUCATION

SPH 441: MICROPROCESSOR APPLICATIONS AND SYSTEMS

DATE: 3/8/2017

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 (30 MARKS)

- a) i. Outline the main classification of transducers? (1 mark)
- ii. State the two examples of transducers (2 marks)
- 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 four useful applications of Micro-Electro-Mechanical Systems (MEMS) (4 marks)
- ii. Outline two characteristics of typical analog systems (2 marks)
- d) Make truth table for a 3-input (4 marks)
- i. AND gate
- ii. OR gate
- iii. NAND gate
- iv. NOR gate
- e) State any two examples of digital systems (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 (20 MARKS)

- 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 (20 MARKS)

- 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 (20 MARKS)

- a) Convert the following binary numbers into decimal without the use of a calculator:
- i. 1101
 - ii. 111000
 - iii. 1001101
 - iv. 1011010 (12 marks)
- b) Convert the following hexadecimal numbers to (i) binary (ii) decimal and (iii) octal:
- i. 34_{16}
 - ii. $1A_{16}$
 - iii. DB_{16} (8 marks)

QUESTION FIVE (20 MARKS)

- 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)