

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
SECOND SEMESTER 2018/2019 B.Eng. DEGREE EXAMINATION
COURSE: MCE 323: Microprocessor Based Systems

INSTRUCTION: Answer QUESTION ONE and any other Two Questions.

TIME: 3 Hours

Question One

- a) Student X is currently developing a Robotic arm and as decided to use the PIC 16F887. The student needs to send and receive digital signals via the micro-controller. In addition to the digital signals, it is required that the robotic arm should have the capability of measuring the temperature of any object it comes in contact with. You are required to help student X identify all the possible registers on PIC 16F887 to be used to actualize the robotic arm. Also describe the configuration of the identified registers. **(10 Marks)**
- b) The faculty management as contacted you to design an interactive lighting system for the foyer of the new faculty building. It is required that lighting system be equipped with three Green, three Red and three Blue LEDs, such that each colour set is controlled by a dedicated switch. The operation is such that whenever, an associated switch is pressed the corresponding LEDs are turned ON in a blinking manner for 2minutes. However, if no switch is pressed, the entire system is remained OFF. To this end, you are required to;
- i. Develop the circuit diagram for the system using a PIC 16F887, showing all components **(5marks)**
 - ii. Develop a C-based Program Code to implement the system using PIC 16F887. **(5marks)**
- c) Ahead of the successful completion of your exams, your class captain is planning a big party to usher you into 400Level in ground style. To this end, he has requested that you design a micro-controller-based display system using the 8051. The display system should be made using a LCD and the inscription should be *"Congrats All"* and *"Welcome to 400!"*. To achieve this, you are required to do the following;
- i. Develop the circuit diagram for the system, showing all components. **(5marks)**
 - ii. Develop a C-based Program Code to implement the system. **(5marks)**

Question Two

- a) Livingstone is currently building his capstone project and he is desirous of using the 8051 micro-controller, unfortunately he needs to work with a total memory space size of 6K byte. Hence, it is required to have external memory connected to the 8051. You are required to:
- i. Identify the Pinouts on the 8051 to be used for this task **(2 marks)**
 - ii. Describe the functions of the identified pinouts in i). **(3 marks)**
 - iii. Draw a schematic circuit showing the interconnection of the Pinout and the External memory. **(5 marks)**
- b) Mention five (5) basic features of the 8051 micro-controllers. **(5 marks)**.

Question Three

- a) The coordinator of the practical session of the course has requested you identify the pinouts on the 8051 to be used for the crystal oscillator and to draw the associated schematic diagram of the crystal oscillator to the 8051. (7 marks)
- b) Describe the Instruction of the cycle of the basic microcontroller. (3 marks)
- c) Compare and Contrast the Von-Neumann and the Harvard Computer Architecture. (5 marks)

Question Four

- a) SSS3 students of the FUTMX secondary school while studying Computer Hardware during their JETS club meeting discovered a device suspected to be memory/storage device with the following inscription. “End address 0x0FFF, start address 0x0000” written on it. On seeing this, students became confused and ran to you for help saying: “we are desirous of saving 5KiloByte worth of data on this device but we do not know the capacity”. Can these students save such a data capacity on the device found? Show all calculation as applicable. (5 marks)
- b) Compare and Contrast between the Port A and Port E of the PIC 16F887. (5 marks)
- c) Describe the purpose of the Bootloader when programming the microcontroller. (5 marks)