FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
SECOND SEMESTER 2017/2018 B.Eng. DEGREE EXAMINATION
COURSE : MCE 323: Microprocessor Based Systems
INSTRUCTION: Answer Question one and any other two questions
TIME ALLOWED: 3 Hours

Question One

a) Owing to the 2.8bn Naira released to Department of Mechatronics Engineering by the Federal Government of Nigeria, you have been contacted to add a visual effect to the departmental notice board. You are required to design a microcontroller based lighting system for the existing notice board using a 40Pin 8051 Microcontroller with the following specifications.
   i. The lighting system should consist of 3 different colours (Red, yellow and blue)
   ii. The lighting system should also be a blinking system with each colour having a delay of about 60 seconds.

   To this end, you are expected to do the following.

   1. Design a circuit diagram showing how the 8051 will be connected other circuitries to form a complete blinking system. (10 marks)
   2. Write a PDL of the program to be encoded onto the microcontroller (5marks)
   3. Write a C program for the 8051 using the PDL developed (2) (10 marks)

b) An Engineering firm has approached you due to your expertise in microcontrollers. The firm wants to produce a range of embedded systems using PIC 16F887 microcontrollers. Kindly, outline seven (7) features of the chip that could be of benefit to the firm. (7 marks)
c) Differentiate between a microcontroller and a microprocessor.(5 marks)
d) List 6 basic features of the general 8051 microcontroller.(4 marks)
e) Identify the Ports on the 8051 and briefly describe their functions.(5 marks)
f) Differentiate between the following:
   i.) RISC and CISC Instruction sets. ii.) Harvard and Von-Neumann Architectures (4 marks)

Question Two

a) Engr-A is currently working on an ADC Project and he is desirous of having an analogue input from is sensory station displayed using simple LEDs help with the use of a Simple C program code, attempt solving this problem for him. (Hint: use channel AN0 and Fosc/8) (10 marks)
b) Name seven (7) areas of applications of embedded systems and give 2 examples in each area.(5 marks)
c) List the functions of the following pin outs on the 8051: ALE, PSEN, WR, RD and EA.(10 marks)

Question Three

a) The Nigerian Emergency Management Agency (NEMA) has contacted you as a mechatronics engineer to work on NEMA-ALERT System to be used in flood prone areas. The system is expected to display 'HELP US' on a 7-segment display placed at the organization's office whenever, the alert button is pressed at the prone areas. Draw an

appropriate circuit diagram and write the corresponding C program for the system using the PIC 16F887. (10 marks)

b) Briefly discuss the various types of Bus Architecture of the microcontroller.(8 marks)

c) State the functions of the following registers on the PIC 16F887
   a. ANSEL
   b. TRIS
   c. ADCON (7 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 0x2FF, start address 0x1F**" written on it. On seeing this, students became confused and ran to you for help saying: "we are desirous of saving 512Byte 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. (9 marks)

b) Describe the main Characteristic features of the following software construction techniques:
   i. Monolithic Technique ; Modular Technique ; Independent Technique (6 marks)
   ii. What are the advantages and disadvantages of the above techniques? (4 marks)

c) State 5 basic characteristic features of the PIC 16F887 (6 marks)