B. PRODUCTION ENGINEERING 2ND YEAR 2ND SEMESTER EXAMINATION - 2018

MICROPROCESSOR CONTROL AND MECHATRONICS

Time: Three hours   **Full Marks: 100**

ANSWER ANY FIVE QUESTIONS

1. a) An 8-bit microprocessor that uses 2'complement representation for negative numbers. How do the following decimal numbers appear in binary and hexadecimal forms in it?
     (i) 119   (ii) -79   4

   b) What is meant by 'universal logic gate'? Show that NAND is a universal logic gate.   1+4

   c) State and prove De-Morgan's theorems for multiple variables in general.   5

   d) Explain three different methods of representing signed binary numbers with examples.   6

2. a) What is the limitation of half adder? How is it overcome in full adder?   4

   b) Show a 4-bit controlled 2's complement adder-subtracter, and explain its operation.   10

   c) Show an SR flipflop using two NAND gates only, and discuss the problem of 'race' condition.   6

3. a) Show a 3-bit asynchronous counter, and explain its operation. Show and explain how it can be modified to operate as a mod-6 counter.   10+4

   b) Show a 4x1 multiplexer, and explain its operation.   6

4. a) What are the lengths (in bits) of data bus and address bus in 8085 microprocessor? What is the maximum size (in bytes) of memory accessible with 8085 microprocessor?   2+1

   b) What are the condition flags available in 8085 microprocessor, and what do they indicate? What are the functions of Program Counter (PC) and Stack Pointer (SP) in 8085 microprocessor?   5+4

   c) Explain the different addressing modes used in 8085 microprocessor with suitable examples.   8

[Turn over

5. a) State the operations performed by the following 8085 instructions, and also the lengths (in bytes) of the instructions (**any five**) :

    (i) MOV B, M   (ii) INX B   (iii) ADD M

    (iv) CMP D   (v) LXI D, 2030 H   (vi) JNZ 204A H   10

5.b) Write an assembly language program for 8085 microprocessor to find the smallest number in an array of 8-bit unsigned numbers. The length of the array is in memory location 8000 H, the array begins in memory location 8001 H, and the smallest value should be placed in memory location 7FFF H.   10

6. a) Explain the term 'mechatronics'. What are the essential components in a mechatronic system?   6

  b) What do you mean by open loop and closed loop control systems? What are their relative advantages and disadvantages?   6

  c) What are meant by the following properties of a sensor?

    (i) accuracy, (ii) sensitivity, (iii) resolution, (iv) repeatability   8

7. a) Explain the working principle of an absolute encoder. What is the advantage of Gray code in such encoder?   7+3

  b) Explain the working principle of LVDT in measuring linear displacement. What is meant by sensitivity of LVDT?   9+1

8. a) What are the different types of electrical actuators?   4

  b) Show a schematic diagram of a closed loop speed control system using d.c. servo motor and tachogenerator, and explain its operation.   8

  c) Explain briefly the principle of operation of a solenoid operated directional control valve.   8