

B. PRODUCTION ENGINEERING 2ND YEAR 2ND SEMESTER EXAMINATION - 2019

MICROPROCESSOR CONTROL AND MECHATRONICS

Time: Three hours

Full Marks: 100

ANSWER ANY FIVE QUESTIONS

1. a) An 8-bit microprocessor uses 2's complement representation for negative numbers. How do the following decimal numbers appear in binary and hexadecimal forms in it?
(i) 115 (ii) -85 4
- b) Explain the different methods of representing signed binary numbers with examples. 5
- c) What is the advantage of using 2's complement method over 1's complement method for adding signed binary numbers? 3
- d) What is meant by sequential logic circuit? 2
- e) Show a master-slave JK flipflop, and discuss its advantage over ordinary JK flipflop. 6
2. a) What is the limitation of half adder? How is it overcome in full adder? 4
- b) Show a 4x1 multiplexer, and explain its operation. 6
- c) Show a 4-bit controlled buffer register, and explain its operation. 10
3. a) What is 'serial loading'? Explain how this can be done using a shift register. 10
- b) Show a 4-bit asynchronous counter, and explain its operation. 10
4. a) What are the size (in bits) of the following registers in 8085 microprocessor, and what are they used for?
(i) A (Accumulator) (ii) PC (Program Counter) (iii) SP (Stack Pointer) 6
- b) What are the condition flags available in 8085 microprocessor, and what do they indicate? 6
- c) Explain the different addressing modes used in 8085 microprocessor instructions 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) ADI 25 H | (ii) MOVE B, M | (iii) CMP D | |
| (iv) INX D | (v) LXI D, 2030 H | (vi) JZ 2040 H | 10 |
- 5.b) Write an assembly language program for 8085 microprocessor to add an array of 8-bit unsigned numbers. The length of the array is in memory location 4001 (hex), the array starts from memory location 4002 (hex), and the sum should be placed in memory location 4000 (hex). Assume that the sum will fit in an 8-bit data. 10
6. a) Explain the term ‘mechatronics’. What do you mean by a sensor and an actuator? 4+4
- 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) resolution, (iii) repeatability 6
7. a) Explain the working principle for the measurement of linear displacement using strain-gauge connected in a wheat-stone bridge circuit. 8
- b) Explain the working principle of an optical absolute encoder. What is the advantage of Gray code in such encoder? 8+4
8. a) Show a schematic diagram of a closed loop position control system using dc servo motor and potentiometer, and explain its operation. 10
- b) Explain the principle of operation of a solenoid operated directional control valve with a neat diagram. Also show its symbol. What is meant by a 3/2 valve? 8+1+1