

B. PRODUCTION ENGINEERING 2ND YEAR 2ND SEMESTER EXAMINATION - 2017

MICROPROCESSOR CONTROL AND MECHATRONICS

Time: Three hours

Full Marks: 100

ANSWER ANY FIVE QUESTIONS

1. a) What is a microprocessor? How do the following decimal numbers appear in binary and hexadecimal forms in an 8-bit microprocessor that uses 2's complement representation for negative numbers? (i) 99 (ii) -49 1+4
- b) What is the special characteristic of 'Gray' code? Convert the following Gray codes to binary numbers: (i) 1010 (ii) 1111 2+2
- 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 master-slave JK flipflop, and discuss its advantage over ordinary JK flipflop. 6
- c) Show a 4-bit controlled buffer register, and explain its operation. 10
3. a) Show a 4-bit asynchronous or synchronous counter, and explain its operation. Show and explain how it can be modified to operate as a mod-10 counter. 10+4
- b) Show a 4x1 multiplexer, and explain its operation. 6
4. a) What are the different registers accessible to the programmer in 8085 microprocessor, and what are they used for? 8
- b) Explain the different addressing modes used in 8085 microprocessor with suitable examples. 8
- c) What addressing modes are used in the following 8085 instructions?
(i) STA 2040 H (ii) ADD M (iii) MVI C, 72 H 4

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5. a) State the operations performed by the following 8085 instructions, and also the lengths (in bytes) of the instructions (any five) :
- | | | | |
|------------|-------------------|-----------------|----|
| (i) ADC B | (ii) INX B | (iii) MOV 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 largest 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 largest value should be placed in memory location 7FFF H. 10
6. a) Explain the term 'mechatronics'. What do you mean by (i) a sensor, (ii) an actuator, (iii) a sequential controller, and (iv) a microcontroller? 4+8
- b) What are meant by the following properties of a sensor?
(i) accuracy, (ii) resolution, (iii) repeatability, (iv) sensitivity 8
7. a) What is meant by 'gauge factor' of a strain gauge? What will be the change in resistance of an electrical resistance strain gauge with a resistance of 100 Ω and a gauge factor of 2.0, when it is subject to a strain of 0.001? 1+1
- b) Explain the working principle of measurement of linear displacement using strain-gauge connected in a wheat-stone bridge circuit. 8
- c) Distinguish between incremental and absolute optical encoders. Explain the working principle of an incremental encoder. How can it be used for measurement of angular velocity? 3+6+1
8. a) Show a schematic diagram of a closed loop speed control system using d.c. servo motor and tachogenerator, and explain its operation. 8
- b) What are the different types of electrical actuators? Give examples of each type. 5
- c) Explain briefly the principle of operation of a solenoid operated directional control valve. 7