Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B. TECH (ME / PE) / SEM-6 / ME-602 /2011

2011

MECHATRONICS AND MODERN CONTROL

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) An ideal operational amplifier should have
      a) a high gain and low bandwidth
      b) a low gain but high bandwidth
      c) a high gain, high input impedance and low output impedance
      d) a high gain, low input impedance and high output impedance.

   ii) The device which converts one form of energy into another is called a
      a) Transistor b) Transducer
      c) PLC d) Microcontroller.

iii) The minimum number of NOR gates required to design one XOR gate is

a) 5 b) 4

c) 7 d) none of these.

iv) Stepper motor is efficiently used in

a) closed loop control system

b) open loop control system

c) both (a) and (b)

d) none of these.

v) ASCII code is

a) 4-bit code b) 6-bit code

c) 7-bit code d) 8-bit code.

vi) Flip-flops are

a) monostable device b) astable device

c) bistable device d) none of these.

vii) A double acting cylinder can be controlled by a ..... final control valve.

a) 3/2 DCV b) 5/2 DCV

c) Dual Pressure Valve d) 2/2 Valve.

viii) The analysis of multiple-input multiple-output system is conveniently studied by

a) State-space approach

b) Root locus approach

c) Characteristic equation approach

d) Nicholas chart.

ix) Transfer function of a system is defined as the ratio of output to input in

a) Laplace transform

b) Z-transform

c) Fourier transform

d) Single-algeb aic transform.

x) In a criticall damped system the damping factor of the system is

a) zero b) less than unity

c) unity d) greater than unity.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define the term 'Mechatronics'. Compare the mechatronics approach and traditional approach with an example. 2 + 3

3. What is servo drive ? Write down the function of servo drive. What is the meaning of tuning of a servo drive ?

1 + 2 +2

4. Construct the simplest logic circuit using NAND gates which will give the output as Q = AB'C + A'BC + ABC' + ABC 5

5. What is the principle of a thermocouple ? What are the types of thermocouple ? State with neat sketches. 2 + 3

6. What is a Ladder diagram ? What do you mean by the scan time of PLC ? 3 + 2

7. Write down a short note on *Z*-transform. Show the *Z*-transform of unit step function $f(t) = u(t) = 1$ 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Draw and explain the programming model of 8085 microprocessor.

   b) Explain the different Flags used in 8085 microprocessor.

c) Write an ALP in 8085 microprocessor which will add two number placed in memory locations 2050H and 2501H memory locations. Store the result in 8000h and 8001h memory locations. 5 + 4 + 6

9. a) With net sketches, explain the construction and working principle of the various types of stepper motor.

b) Explain what is meant by Phase, Holding Torque and Pull-in Rate of a stepper motor.

c) Write down a short note about linear motion bearing.

6 + 6 + 3

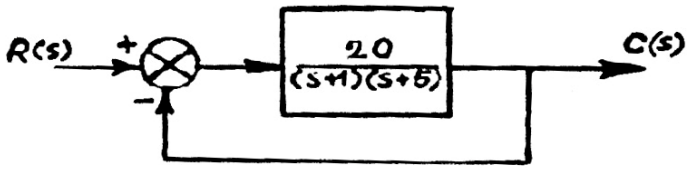
10. a) Explain how a sequenti l value can be used to initiate an operation only when another operation has been completed.

b) In diverting mechanism, articles will be moving on a main conveyor. It is required to segregate articles from other types, these articles have to be diverted to another conveyor running parallel from the main conveyor. Draw a hydraulic circuit for a diverting device whose cylinder can be actuated by any one of the two push button valve, return stroke can be achieved by pressuring another push button valve.

c) Discuss the principle of working of a solenoid control valve.

d) Describe the working principle of Time-delay valve with the help of schematic diagram. 3 + 6 + 3 + 3

11. a) The block diagram of a unity feedback control system is shown in figure below. Determine the characteristic equation of the system ω_n, ξ, ω_d, t_p, M_p, the time at which the first undershoot occurs, the time period of the oscillations and the number of cycles completed before reaching the steady sta e



b) What is an adaptive control system ? Sketch its block diagram. Discuss the types of different adaptive control systems. 8 + (4 + 3)

12. Write short notes on any three of the following : $3 \times 5 = 15$

a) Mechatronics design process

b) NAND gate and NOR gate are universal gate

c) Strain Gauge

d) State space analysis

e) Poles and zeros of a transfer function.

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