*Name :* .....

*Roll No. :* .....

*Invigilator's Signature :* .....

**CS/M.Tech(ME)/SEM-2/MMT-204B/2013**

# 2013

# 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 any *ten* of the following : 10 × 1 = 10

i) Inductive type Transducer is

a) Potentiometer b) Strain Gauge

c) Tachometer d) LVDT.

ii) 8086 Microprocessor is ..... Bit processor.

a) 4 b) 8

c) 16 d) 32.

iii) Laplace Transform of unit step function is

a) $s$ b) $\frac{1}{s}$

c) $s^2$ d) $\frac{1}{s^2}$.

iv) The Boolean equation for the NAND gates is

a) $A \cdot B = Q$

b) $\overline{A} = Q$

c) $A + B = Q$ when $A$, $B$ are input and $Q$ is the output

d) None of these.

v) Self generating transducer are

a) Passive transducer

b) Active transducer

c) Primary transducer

d) Secondary transducer.

vi) Stepper motor is efficiently used in

a) Closed loop control systems

b) Open loop control systems

c) Both (a) and (b)

d) None of these.

vii) 5/3 directional control valve means

a) 3 port an 5 positions

b) 8 ports and 3 positions

c) 3 ports and 8 positions

d) 5 positions and 3 ports.

viii) The binary equivalent to ( 39)D is

a) 100111 b) 101001

c) 111000 d) none of these.

ix) Flip-flops are

a) Asynchronous tri-state device

b) Synchronous tri-state device

c) Synchronous bi-stable device

d) none of these.

x) The example of solid state switch is

a) Diode b) Thyristor

c) Triac d) All of these.

xi) The 8085 flag register is a register of

a) 5 bit b) 64 bit

c) 8 bit d) 16 bit.

xii) 1 : $n$ demultiplexer should have $m$ select line such that

a) $2^n = m$ b) $2^m = n$

c) $m = n$ d) none of these.

xiii) The basic parts of a mechatronic system is

a) Simulation and modeling

b) Automatic control

c) Optimization

d) All of these.

xiv) The condition of a normal poppet valve is

a) Open

b) Close

c) Either open or close

d) none of these.

## GROUP – B

**( Short Answer Type Questions )**

Answer any *three* of the following. 3 × 5 = 15

2. What is Mechatronics ? How does it help in designing and manufacturing products ?

3. What is an adaptive control ? Explain with a neat sketch.

4. What do you mean by closed loop transfer function ? Explain.

5. With schematic diagram, make the comparative features between value pump and gear pump.

6. Construct the simplest logic circuit using different types of logic gate which will give the output as

$$Q = A\bar{B}C + \bar{A}BC + AB\bar{C} + ABC$$

## GROUP – C

**( Long Answer Type Questions )**

Answer any *three* of the following. 3 × 15 = 45

7. a) What id the purpose of a pressure relief valve ? Describe its operation with the help of a schematic diagram and also discuss the differences between pressure relief valve and pressure reducing valve. 1 + 3 + 2

b) Design a hydraulic circuit which is to be utilized for a drill work. The system utilizes two linear actuators — one for clamping the job and another for drilling :

(i) Clamp the job

(ii) Drill the job

(iii) Retract the drill spindle

(iv) Unclamp the job. 6

c) Discuss the principle of working of a solenoid control valve. 3

8. a) Compare the characteristics of open loop and closed loop control system in machines or process control applications. 5

b) A closed loop system shown in Figure. 1 has a process transfer function $G(s) = \frac{1}{s(s+4)}$ and is used with proportional control. Obtain the following :

(i) the system type

(ii) the steady-state errors when a step input and ramp input. 10

9. a) What are the Logic gates ? Show NAND gate is equivalent to NOT-OR gate.

   b) Discuss EX-OR gate and write down its truth-table. Realize the following expression using the basic gates of $X + Y\overline{X} + \overline{X}Z$. 7 + 8

10. a) Name at least one each of the contact sensor and non-contact sensor. How do they work ? Explain the principles.

    b) What are the different actuators used in Mechatronics system ? With the aid of a sketch, explain the principle of working of any actuator system. 8 + 7

11. a) Name five data transfer instructions used in 8085-μp. Discuss any one in details. What are the functions of PRESET and HOLD pin in 8085-μp ?

    b) How does a PLC function ? Illustrate your answer with the use of PLC in some example of industrial product.

8 + 7