MECHATRONICS & CONTROL SYSTEMS
(MECH 3232)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Linear to rotary motion transformation is obtained by following mechanism,
(a) Gear and pinion (b) Rack & pinion
(c) Ball & socket (d) worm & worm-wheel.

(ii) A 5/3 direction control valve has
(a) 4 ports 3 position (b) 3 ports 3 position
(c) 3 ports 4 position (d) 5 ports 3 position.

(iii) Ratio of change in output of sensor to the input to the sensor is called
(a) Threshold (b) Slew rate (c) Sensitivity (d) Stability

(iv) Which of the following is not an analog sensor?
(a) Potentiometer (b) Strain gauge
(c) Accelerometer (d) Inductive type proximity sensor

(v) A filter that rejects signals of all frequencies below a particular value is
(a) Low pass (b) High pass (c) Band pass (d) band reject.

(vi) Which control system has feedback loop?
(a) Open loop system (b) Closed loop system
(c) Both (a) and (b) (d) None of the above.

(vii) What is the ratio of amplitude of response to that of the input called?
(a) Response (b) Gain (c) Phase (d) Frequency.

(viii) Which of the following input field devices would most likely be used with an analog input module of PLC?
(a) Limit switch (b) Pushbutton,
(c) Thermocouple (d) Selector switch.

(ix) How are the bits of the register PSW affected if we select register Bank 2 of 8051?
(a) PSW.5=0 and PSW.4=1 (b) PSW.2=0 and PSW.3=1
(c) PSW.3=1 and PSW.4=1 (d) PSW.3=0 and PSW.4=1.

(x) MOV A, R4 exhibits which addressing modes
(a) Immediate Addressing (b) Register Addressing
(c) Direct Addressing (d) Register Indirect Addressing

Group – B

2. (a) What are the different components of a Mechatronic system? Explain with an example.

(b) Explain the working of servomotor with block diagram.

(2 + 4) + 6 = 12

3. (a) Give a comparison between a pneumatic drive and a hydraulic drive.

(b) Show a pneumatic circuit to operate a pneumatic cylinder for its automatic forward and reverse motion using such valve and pneumatic limit sensors.

6 + 6 = 12

Group – C

4. (a) What is transducer? What are the advantages of electrical transducer over mechanical transducer? Explain with an example, how to measure temperature with a sensor?

(b) Explain the construction and principle of working of a linear variable differential transformer (LVDT). Explain how the magnitude and direction of the displacement of core of an LVDT detected?

(1 + 2 + 3) + (4 + 2) = 12

5. (a) What are the different processes in signal conditioning? Explain in brief. Why digital signals are preferred over analog signal?

(b) What are the basic elements of data acquisition system? Explain with diagram.

(7 + 2) + 3 = 12

Group – D

6. (a) What is Transfer function? What is Rise time, Settling time, maximum overshoot and steady state error for a system?

(b) Show the time response of Proportional, Proportional Derivative and Proportional Integral for step input?

(2 + 4) + (2 + 2 + 2) = 12

7. (a) For a spring-mass-damper system with m = 10 kg, k = 12 N/m, and b = 10 Ns/m. Write its transfer function equation and the steady state response equation for
(i) Step input of 20 N and
(ii) Sinusoid input of 20 sin(0.75t) N.
(All terms have their usual meaning)

(b) Draw Bode plot asymptotes for systems having the transfer functions 200/s(s+5).

8 + 4 = 12

Group – E

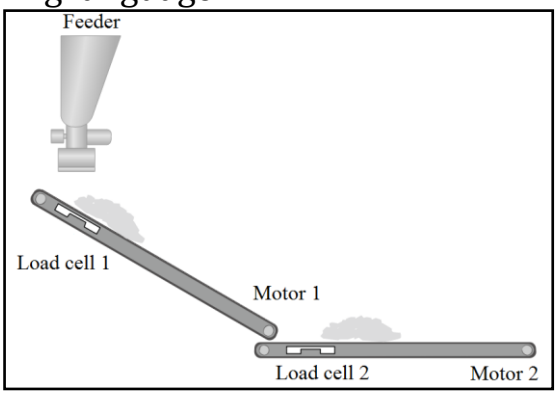
8. (a) What is microcontroller? Find the timers clock frequency for the crystal frequency of 11.0592MHz of an 8051 microcontroller?

(b) Explain Register Indirect Addressing mode with example. Write an Assembly language program to divide 93H by 0CH and store the quotient and remainder at 25H and 26H respectively.

(2 + 2) + (2 + 6) = 12

9. (a) What are the advantages of a PLC over a hard-wired relay logic system?

(b) A feeder drops material on the conveyor which sends material for further process through one more conveyor. Conveyor must start automatically when material is dropped on it. Implement automation of this in PLC using Ladder Diagram programming language.



5 + 7 = 12

Department & Section	Submission Link
ME	https://classroom.google.com/c/Mjk4ODYyOTg4Njk2/a/MzY0NTQ3NzYzODE3/details