

[3 Hours]

[Total Marks : 80]

Please check whether you have got the right question paper.

- N.B:**
1. **Q.1 is compulsory.**
 2. **Attempt any three** questions from remaining questions.
 3. **Draw neat sketch** whenever required.
 4. **Assume suitable data if necessary.**

1. Attempt any Five (20)
 - (a) Explain volume Booster as a control system component.
 - (b) What are live zero and dead zero concepts in the view of transmission of signal?
 - (c) How to choose ATO and ATC control valves for various process control applications?
 - (d) Tell about rupture disk with suitable diagram.
 - (e) Give constructional details about Electromechanically Relay.
2. (a) Draw and explain single acting cylinder, double acting cylinder and special types of double acting cylinders. (10)
 - (b) What is the necessity of valve positioner? Explain motion balance valve positioner. (10)
3. (a) Compare Pneumatic, Hydraulic and Electric systems based on various parameters. (10)
 - (b) Classify control relays and describe any one of them in detail. (10)
4. (a) Sketch and explain alarm annunciator system. Also list out types of annunciators. (10)
 - (b) Why is standardization of signal required? Explain SMART transmitter with neat sketch. (10)
5. (a) Give industrial applications of Control Valve. Also elaborate structure of Globe control valve. (10)
 - (b) What are the Directional Control Valves? Describe Shuttle and check valve with symbols. (10)
6. Write short notes on (20)
 - a) Hydraulics lobe pump
 - b) Electric to pneumatic converter
 - c) Solenoid valve
 - d) Toggle and DIP switch.

Time- 3 Hours

Total Marks-80

N.B.: (1) Question No. 1 is compulsory.(2) Attempt any **three** questions from remaining **five** questions.(3) Assume suitable **data** wherever necessary.(4) Figure to right indicate **full** marks.(5) Illustrate your answer with neat **sketches** wherever necessary.

1. Answers the following questions:- (20)
 - a) Explain Harvard and Von Neumann architecture with block diagram.
 - b) Discuss memory organization of RAM in 8051 Microcontroller.
 - c) LEDs are connected to bits P1 and P2. Write an 8051 C program that shows the count from 0 to FFH on the LEDs.
 - d) Explain SBUF register of 8051 microcontroller and explain procedure how data is loaded in to SBUF.

2. a) List the important features of RISC and CISC processors. (8)
 - b) Compare 8051, 8052 and 80151 microcontrollers. (8)
 - c) Explain Timer 2 operation in Auto-Reload mode of 8052 microcontroller. (4)

3. a) Write assembly program to convert packed BCD 99H to two ASCII numbers and describe the logic used for this conversion. (10)
 - b) Write an 8051 C program to send two different strings to the serial port. Assuming that SW is connected to pin P2.0, monitor its status and make a decision as follows:
 SW = 0: send HI
 SW = 1: send BYE.
 Assume XTAL = 11.0592 MHz, baud rate of 9600, 8-bit data, 1 stop bit. (10)

4. a) Explain interfacing of DC motor with 8051. Add a switch to pin P2.7. Write a program to monitor the status of switch and if SW= 0, the DC motor moves clockwise and if SW = 1, the DC motor moves counterclockwise. (10)
 - b) The word "NIKITA" is to be burned in the ROM location starting from 0400H. Write assembly language program to do this and to read this into internal RAM location starting from 50H. (10)

5. a) Interface LCD with 8051 microcontroller. Write a assembly program to display "HELLO" using MOVC instruction. (10)
 - b) Write a program to copy the value 55H into RAM memory locations 40H to 45H using
 - (i) Direct addressing mode,
 - (ii) Register indirect addressing mode without a loop, and
 - (iii) With loop. (10)

6. Attempt any **TWO** questions:-

(20)

- a) Write a program to generate a square wave of 50% duty cycle on the P1.5 bit. Timer0 is used to generate the time delay. Calculate the amount of time delay. Assume XTAL=11.0592MHz.
- b) Draw and explain Interrupt internal circuit diagram with its registers of 8051 Microcontroller.
- c) Explain implementation of Traffic Light Controller using 8051 microcontroller.



Time: 3 Hours

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- (1) Question no. 1 is compulsory.
- (2) Attempt any three questions from remaining five questions.
- (3) Assume suitable data wherever necessary.

- Q.1. (a) Explain the terms: 20
- (i) Signal Level and Bias changes
 - (ii) Filtering and impedance matching
- (b) Draw and explain zero crossing detector circuit.
- (c) Define filters. What are the advantages of active filters over passive filters?
- (d) A bridge circuit has $R_1 = R_2 = R_3 = R_4 = 120\Omega$ resistances and a 10V supply. Suppose a $3^{1/2}$ digit DVM on a 200mV scale will be used for the null detector. Find the resistance resolution for measurements of R_4 .
- Q.2. (a) Explain with neat block diagram, the generalized Data Acquisition System. 10
- (b) Explain Dual slope Analog-to-digital Converter with diagram and waveform. 10
- Q.3. (a) Derive output voltage equation for 3 op-amp instrumentation amplifier. Explain any one typical application with neat diagram. 10
- (b) Draw the circuit for practical integrator. Draw the frequency response of ideal and practical integrator. Discuss the problems associated with ideal integrator. 10
- Q.4. (a) Design and explain operation of astable multivibrator using IC555 to generate output signal with frequency of 1kHz and duty cycle of 75%. 10
- (b) Draw and explain the principle and construction of metal strain gauges. What is the signal conditioning associated with it. 10
- Q.5. (a) Draw and explain circuit diagram of sample and hold circuit with waveforms and list the applications. 10
- (b) A potentiometer displacement sensor is to be used to measure work-piece motion from 0 to 10cm. The resistance changes linearly over this range from 0 to 1k Ω . Develop signal conditioning to provide a linear, 0 to 10V output. 10
- Q.6. Write short notes on any four of the following. 20
- (a) SMPS
 - (b) Data logger
 - (c) PLL
 - (d) Peak detector

(3 Hours)

Total Marks: 80

- N.B. 1. Question No.01 is **Compulsory**.
 2. Attempt any **three** questions from remaining **five** questions.
 3. Assume suitable data if required.
 4. Figure to right indicate full marks.

Qu.01. Answer the following 20

- Explain the need of compensator.
- Define controllability and observability.
- State the advantages of modern control theory over conventional control theory.
- Derive the transfer function of lead compensator.

Qu.02. a) Explain design steps of lag compensator using Bode plot technique. 10

b) Obtain the diagonalized matrix (M) for given system matrix: - 10

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -3 & -3 \end{bmatrix}$$

Qu.03. a) Design PID Controller for the system 10

$$G(s) = \frac{K}{s(s+1)(s+5)}$$

Determine the compensated block $G_C(s)$.

b) Open loop transfer function of uncompensated system is 10

$$G(s) = \frac{K}{s(s+1)(s+2)}$$

Design lead compensator to meet following specification:-

Damping factor $\zeta = 0.7$, undamped natural frequency $\omega_n = 1.5$ rad/sec and $K_V \leq 5$.

Qu.04. a) Obtain the response of the system which is represented by following state equation 10

$$\dot{X} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U$$

Assume initial conditions $X(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$

b) Explain the design steps of lag-lead compensator using root locus technique. 10

Qu.05. a) For a unity feedback system

10

$$G(s) = \frac{K}{s(s+1)}$$

Design a suitable compensator with the following specification:-

$$K_V = 12 / \text{sec}$$

$$\text{Phase Margin } \Phi_m = 40^\circ$$

b) Obtain the state feedback matrix K for the system

10

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -5 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U(t)$$

$$Y(t) = [1 \quad 0] X(t)$$

The closed loop poles are at $-1.5 \pm j 1.5$.

Qu.06. a) What is state transition matrix (STM)? List the properties of STM.
Compute the STM for a system matrix:-

10

$$A = \begin{bmatrix} 0 & 1 \\ -1 & -3 \end{bmatrix}$$

b) Obtain transfer function of the following system

10

$$\begin{bmatrix} \dot{X}_1(t) \\ \dot{X}_2(t) \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} X_1(t) \\ X_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} U(t)$$

$$Y(t) = [1 \quad 1] X(t)$$

N.B.: (1) Question No 1 is compulsory

(2) Solve any Three Questions from Question No 2 to Question No6

(3) Assume suitable data if required.

Q1) Solve any four

- a) Explain in brief ROC conditions of z transform.
- b) Sketch even & odd parts of $x(n)=u(n)-u(n-5)$.
- c) Find Initial and final values of signal $x(s) = \frac{(s+10)}{(s^2+2s+2)}$
- d) Determine Z transform and ROC of signal $x(n)=a^n \cos(\omega n)u(n)$
- e) Explain Gibb's Phenomenon.

20

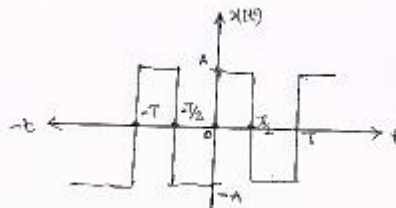
Q2) a) Determine the convolution of the following signal using graphical method.

08

$$X_1(n) = \left\{ 1, 2, 1 \right\} \quad \text{and} \quad X_2(n) = \left\{ 2, 1, 2 \right\}$$

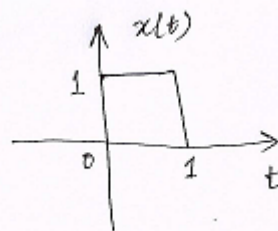
b) Determine Fourier series representation of following signal.

08



c) Determine Laplace transform of following waveform.

04



Q3) a) Solve the difference equation for the system given below using z-transform.

08

$$y(n]-3y(n-1)-4y(n-2)=x(n)+2x(n-1)$$

b) Obtain inverse Laplace transform with all possible ROC.

08

$$X(s) = \frac{8}{(s+2)^3(s+4)}$$

c) State and prove time shifting property of continuous time Fourier transform.

04

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Q4) a) Compute the convolution integral and sketch output. 08

$x(t) = 1$ for $0 \leq t \leq 2$

$= 0$ otherwise

$h(t) = e^{-2t} u(t)$

b) Find inverse Z-transform of $x(z) = \frac{z^2}{z^2 - z + 0.5}$ 08

c) Determine whether following signals periodic or not. If periodic find fundamental period. 04

i) $x(t) = 14 + 40\cos(60\pi t)$

ii) $x(n) = \cos^2\left[\frac{\pi}{4}n\right]$

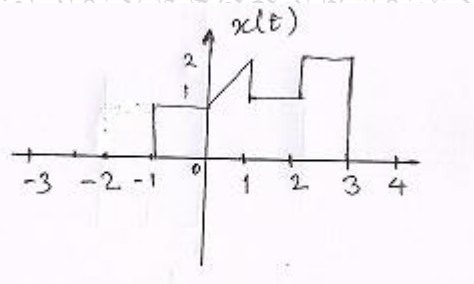
Q5) a) Determine whether the following signals are energy or power. 08

i) $x(t) = e^{-4t} u(t)$

ii) $x(n) = \left(\frac{1}{6}\right)^n u(n)$

b) Sketch the following signals, if $x(t)$ is as shown below. 08

i) $x(-t)$ ii) $x(2t+2)$ iii) $x(-t+2)$ iv) $x(-2-t)$



c) State relationship between Laplace, Fourier and Z- transform. 04

Q6) a) Determine if following systems are memoryless, causal, linear, timeinvariant. 04

$y(n) = a^n x(n)$

b) Plot the signal w.r.t.time. 08

$x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$

c) The differential equation of the system is given by $y''(t) - y'(t) - 6y(t) = x(t)$. Find 08

i) $H(s)$

ii) $h(t)$

iii) Step response of the system.