TE - Sem-V -(CBSGS) - INST - Signals & Systems - NOV-16

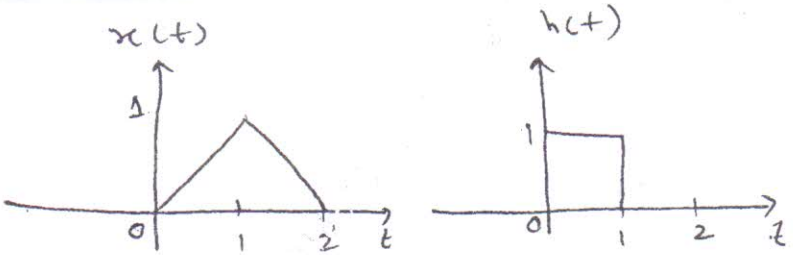
Q.P. Code : 597802

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No.**1** is **compulsory.**
(2) Attempt any **3** out of **5** questions.
(3) Assume suitable data if required.

1. Solve the following [any **four**] **20**
   (a) Find the Laplace transform of following signal
   $x(t) = e^{2t}u(-t) + e^{3t}u(t)$.
   (b) Determine whether the signal is energy or power $x(t) = e^{-2t}\,u(t)$.
   (c) Plot the signal with respect to time.
   $x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$
   (d) Find the Z-T of signal and specify ROC. $x(n) = 2^n u(-n-1)$.
   (e) Determine fourier transform of signal $x(t) = \cos w_o t$.

2. (a) Obtain the convolution of 2 signals. $y(t) = x(t) * h(t)$. **8**



   (b) Explain Dirichlet condition for the convergence of the fourier series. **4**

   (c) Obtain the Inverse Laplace transform of $X(S) = \dfrac{1}{(S+1)(S+2)}$ with all ROC conditions. **8**

3. (a) Obtain inverse Z-T of following X [Z]. **8**

   (i) $X(Z) = \dfrac{Z^2 + Z}{Z^2 + 2Z + 1}$ $|Z| > 1$

   (ii) $X[Z] = Z^2 - 2Z - 1 + 3Z^{-2} + \dfrac{1}{2} Z^{-5}$

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(b) Find and sketch fourier transform X (w) of the non-periodic rectangular pulse at 0. $x(t) = 1$ for $|t| < T_1$ $= 0$ for $|t| \geq T_1$ 8

(c) Find the even and add odd part of signal 4

(i) $x(n) = u(n) - u(n-4)$

4. (a) Check whether the following systems are static/dynamic, Linear/Non Linear, Time variant / time Invariant causal/ Non causal, stable/ unstable and Invertible/Non Invertible. 8

(i) $y(t) = 2x(t) + 2x(t-3)$.

(ii) $y(n) = x^2(n)$.

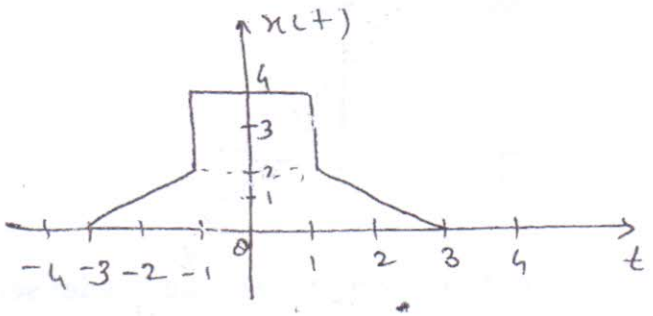
(b) State and prove time shifting property of fourier transform. 4

(c) x(t) signal is shown below. Sketch 6

(i) $y_1(t) = 2x\left(\frac{t}{2} - 1\right)$.

(ii) $y_2(t) = x(1-t).\ u(t)$

(iii) $y_3(t) = -x(2t+3)$.



(d) Evaluate $x(t) * \delta(t-to)$ 2

5. (a) Difference equation of system is given by 10

$y(n) = 3y(n-2) + 4y(n-1) + x(n)$ if $x(n) = (0.5)^n u(n)$ and $y(-1) = 1$, $y(-2) = 0$.

Find (i) Zero input response

(ii) Zero state response.

(iii) Total response.

(b) Determine whether the following signals are periodic or non periodic? If periodic find fundamental period. 6

(i) $x(t) = 2\cos t + 3\cos\frac{t}{3}$

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

(c) State and prove time shifting property of Z-Transform. 4

6. (a) A cousal LTI system has transfer function $H(Z) = H_1(Z)\ H_2(Z)$. 12

$H_1(Z)=\frac{1-0.2Z^{-1}}{1+0.5Z^{-1}}$ and $H_2(Z)=\frac{1}{1+0.3\,Z^{-1}}$

(i) If system is stable give ROC condition

(ii) Find the Impulse response.

(iii) Find system response if $X(Z)=\frac{1}{1-0.2\,Z^{-1}}$

(iv) Draw pole zero diagram.

(b) Discuss the Relation ship between Z transform, Laplace transform and Fourier Transform. 4

(c) Impulse response of a LTI system is $h(n) = \{1, 2, 1, -3\}$ 4
Find out the response of the system to the input signal
$x(n) = \{1, 2, 3, 1\}$

TE/Sem-V(CBSGS)/INST/Applications of Microcontroller -I NOV-16

Q. P. Code : 597500

(03 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.

1. Attempt **any Five** questions- 20
   a) Explain RISC architecture.
   b) Write a program to convert FFH hexadecimal number to decimal.
   c) Explain bit addressable memory of 8051.
   d) Give comparisons between 8051µc and 8085µp.
   e) Explain in short I^2C.
   f) Write a program to initialize the serial port to operate as an 8-bit UART at 2400 baud.

2. a) Draw and explain the Port1 and Port2 internal structures of 8051µc. 10
   b) A switch is connected to pin P1.7. Write a program to check the status of SW and perform the following: 10
      i) If SW = 0, send letter N to P2 and
      ii) If SW = 1, send letter Y to P2.

3. a) Explain addressing modes of 8051 with instruction example. 10
   b) Draw and explain the interfacing of ADC with 8051 and write a program to select channel 2, read the data and calls conversion and display subroutines. 10

4. a) Explain with neat diagram the power saving and power down mode of 8051 in details with PCON register. 10
   b) Explain Timer2 in Capture mode and Auto reload mode with neat diagram. 10

5. a) How do you explain with diagram to interface a dc motor with 8051 microcontroller and also write an 8051 program to run the dc motor in both forward and reverse direction with delay? 10
   b) The word "RAJ" is to be burned in the flash ROM location starting from 0400H of microcontroller. Write a program to do this and to read this data into internal RAM locations starting from 60H. 10

[TURN OVER]

6. Attempt **any two-** 20

a) Draw complete circuit diagram for interfacing the LCD module to 8051 µc. State steps for sending data to the LCD module.

b) Write an 8051C program to send the two messages "Normal Speed" and 'High Speed' to the serial port. Assuming that SW is connected to pin P2.0, monitor its status and set the baud rate as follows:

SW = 0, 28,800 baud rate

SW = 1, 56K baud rate.

Assume that XTAL = 11.0592 MHz for both cases.

c) Write a program and draw flow chart to add the first ten natural numbers using 8051 microcontroller.

E/INST/Sem-V-CBSGS/Control System Design/Nov-16

QP Code : 597702

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. **1** is compulsory
(2) Attempt **any three** questions out of remaining **five** questions.
(3) Assume suitable data if necessary.

1. Attempt the following :- **20**
   (a) What are the advantages of modern control system over conventional control system.
   (b) What is compensator? Explain cascade and feedback compensation with neat diagram.
   (c) Derive the transfer function for electrical lead compensator.
   (d) Define state, state variable, state vector and state model of a system. Also draw block diagram of state model.

2. (a) Consider a unity feedback control system with open loop transfer function. **10**

$$G(s) = \frac{k}{s(s+50)}$$

Design a PI controller to meet following specifications.
% Mp = 20%, Ts = 2 sec.

   (b) Derive the transfer function of electrical lag-lead compensator also draw the pole-zero plot. for the same. **10**

3. (a) Construct state models for the following. **10**

(1) $T(s) = \frac{s^3 + 2s^2 + 4s + 6}{s(s+1)(s+2)}$

(2) $\dddot{Y} + 6\ddot{Y} + 11\dot{Y} + 6Y = 6U$

(3) $\frac{d^3y}{dt^3} + 3\frac{d^2y}{dt^2} + 2\frac{dy}{dt} = u$

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[TURN OVER]

(b) Diagonalise the following matrix 10

$$A=\begin{bmatrix}4 & 1 & -2\\ 1 & 0 & 2\\ 1 & -1 & 3\end{bmatrix}$$

4. (a) An open loop transfer function is 10

$$G(s)=\frac{k}{s(s+1)(s+4)}$$

the system is to be compensated to meet the following specifications.
Damping ratio = 0.5
Ts = 10 sec
Kv $\geq$ 5 /sec

(b) A dynamic system is described by the state variable equation 10

$$\dot{x}=\begin{bmatrix}0 & 1\\ 0 & -2\end{bmatrix}x \quad \text{and } y=[3 \quad -1]\,x$$

initial conditions are $\begin{bmatrix}0\\ 2\end{bmatrix}$. Obtain state transition matrix also determine homogeneous response of the system.

5. (a) Explain the design procedure for lag compensator using Bode plot. 10

(b) $A=\begin{bmatrix}0 & 0 & 0\\ 0 & -1 & 1\\ 0 & -1 & -10\end{bmatrix}$, $B=\begin{bmatrix}0\\ 0\\ -10\end{bmatrix}$ 10

Desired poles are,

$S=-1\pm j\sqrt{3}$, -10

Determine the state feedback gain matrix of the above system.

6. (a) A System whose open loop transfer function 10

$$G(S)=\frac{k}{S(s+1)(s+4)}$$

The system is to be compensated to meet following specifications,

Damping ratio = 0.4
Ts = 10 sec
Kv $\geq$ 5/sec
phase margin (ϕ_m)=43°

(b) Check controllability and observability of the following systems. **10**

(i) $$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$$

(ii) $$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 10 & 0 & 0 \end{bmatrix} x$$

TE/INST/Sem-V(CBSGS)/Signal Conditioning/Nov-16.

Circuit Design **Q.P. Code : 597600**

3 Hours **[Total Marks : 80**

(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 significance of all pass filter. 20

(b) Draw and explain zero crossing detector circuit.

(c) Design a high impedance amplifier with a voltage gain of 42.

(d) Explain the terms:

(i) Signal Level and Bias changes
(ii) Filtering and impedance matching

Q.2. (a) Draw and explain circuit diagram of absolute value circuit using op-amp. 10

Discuss its advantages over traditional diode rectifier.

(b) What is a multivibrator? Design astable square wave generator using IC 555 and determine timing components for frequency of 10 kHz. 10

Q.3. (a) List the applications of instrumentation amplifier. Explain any one in detail. 10

(b) Discuss problems associated with ideal integrator. Draw the circuit for practical integrator. Determine the output voltage for an input step (dc) voltage of 2V and $R_iC_f = 1$ second. Assume that the op amp is initially nulled. Sketch the input and output waveform. 10

Q.4. (a) A sensor outputs a voltage ranging from -2.4 to -1.1V. For interface to an analog-to-digital converter, this needs to be 0 to 2.5V. Develop the required signal conditioning. 10

(b) What are the advantages of active filters over passive filters. Design a second order low pass Butterworth filter for a high cut-off frequency of 1kHz. 10

Q.5. (a) Draw and explain the principal and construction of metal strain gauges. What is the signal conditioning associated with it? 10

(b) A strain gauge with GF = 2.03 and R = 350Ω is used in the bridge. The bridge resistors are $R_1 = R_2 = 350\Omega$ and the dummy gauge has R = 350 Ω. If a tensile strain of 1450μm/m is applied, first the bridge offset voltage if $V_s = 10.0V$. Find the relation between bridge off-null voltage and strain. How much voltage results from strain of 1micro? 10

[TURN OVER]

Q.6. Write short notes on any four of the following. 20

(a) SMPS

(b) Data acquisition system

(c) Sample and hold circuit

(d) PLL

(e) Dual Slope A to D converter

(f) V to F converter

TE/INST-V/CBSGS - Control System Components
Nov-16

QP Code : 597402

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No.1 is compulsory
(2) Attempt any three questions from remaining five questions.
(3) Draw neat diagrams wherever required.
(4) Assume suitable data if required.

1. Solve any **Five**. **20**
   (A) Explain ATC & ATO control valves.
   (B) Explain Volume Booster as control system component.
   (C) Compare conventional & SMART Transmitters.
   (D) Describe working of pressure Relief valve.
   (E) Compare pneumatic, Hydraulic & Electrical system.
   (F) Explain Types of switches with symbols.

2. (A) Explain with a neat sketch working of NO Contactor. Draw wiring scheme to START/ STOP Pump using Starter & Contactor. **10**
   (B) What is necessity of control valve in process industry? Explain Operation of Single seated Globe Control valve with various parts & MOC. **10**

3. (A) Explain with Block diagram working of SMART transmitter. State its Features. **10**
   (B) Why valve positioner is necessary? Explain Motion balance valve positioner with diagram. **10**

4. (A) Explain components of Air supply Distribution system. How will you control Compressor using Pressure switch. **10**
   (B) Explain various Types of Directional control valves used in Pneumatics. **10**

5. (A) Why Transmitter is required in Process Measurements? Explain open Tank Level Measurement using Differential Pressure Transmitter. Draw wiring diagram of the same. **10**
   (B) State working & Advantages of various types of Actuators. **10**

6. Write short notes on: **20**
   (A) Selection criteria for Transmitters.
   (B) RFID.
   (C) Control Relay.
   (D) Thermostat.
