T.E. / Sem-V / CBSGS / INST / Nov. Dec. 2015 / Signal & Systems

QP Code : 5734

(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 if necessary.

1. Solve the following :– **20**

(a) Show that
$x(t) * \delta(t-to) = x(t-to)$

(b) Obtain the linear convolution of given signals. Also sketch the result.

$x(t) = 1$ for $0 \le t \le 1$
$= 0$ elsewhere
$h(t) = 1$ for $0 < t < 1$
$= -1$ $1 \le t \le 2$
$= 0$ elsewhere

(c) Find the z-transform of the signal

$x(n) = \left(\frac{1}{2}\right)^n \cos(w_0 n)\, u(n)$. Specify it's ROC.

(d) State and explain Dirichlets conditons for the existance of continuous time fourier series.

(e) Find the fourier transform of the signal

$x(t) = \frac{d}{dt}\,[(e^{-3t}\, u(t)) * (e^{-2t}\, u(t-2))]$

2. (a) Find if the following sequences are periodic or not. If yes find it's fundamental period. **6**

(i) $x1(n) = e^{j(\pi/4)n}$
(ii) $x2(n) = 3 \sin(1/8)n$

(b) Plot the following sequences :– **10**

(i) $x1(n) = (-2)^n\, u(n)$
(ii) $x2(n) = 2 + u(t-4) + u(-t)$
(iii) $x3(n) = 2^n\, u(-n-1)$

(c) Find bilateral z-transform of the signal **4**
$x(n) = 9\, \delta(n+2) + 3\, \delta(n+1) - 4\, \delta(n) + 3\delta(n-2) + 4\delta(n-4)$

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3. (a) Solve the difference eguation 10

$$y(n)-\frac{1}{9}y(n-2)=x(n-1)$$

with $y(-1) = 0$, $y(-2) = 1$, $x(-1) = 0$ and $x(n) = 3\ u(n)$

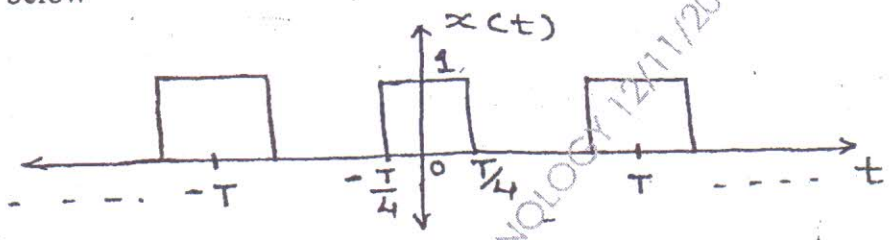
(b) Classify the following system for memory, linearity, causality, time variance and stability. 5

$y(n) = a\ x(n) - b\ x(n-1)$

(c) Find x(t) corresponding to FT 5

$$x(jw)=\frac{-jw}{(jw)^2+3jw+2}$$

4. (a) Determine complex exponential fourier series for the signal x(t) shown below 10



(b) Determine z-transform of following function 10

(i) $x(n)=\left(\frac{2}{3}\right)^n u(n+2)$

(ii) $x(n)=n\left(\frac{5}{8}\right)^n u(n)$

(iii) $x(n) = (0.6)^n\ u(n) * (0.9)^n\ u(n)$

5. (a) Find laplace transform of $x(t) = te^{-3t}\ u(t)$. Prove the property used. 5

(b) Find fourier transform of SINC function. 5

(c) Find the inverse laplace transform of 10

$$x(s)=\frac{-3}{(s+2)(s-1)}$$

If the ROC is

(i) $-2 < Re(s) < 1$

(ii) $Re(s) > 1$

(iii) $Re(s) < -2$

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6. (a) If $x(t) \leftrightarrow x(w)$ is fourier transform pair then prove that $x(t) \leftrightarrow 2\pi\, x(-w)$ 5

(b) Find the initial and final values of the signal 5

$$x(z) = \frac{(z-3)z}{(z-1)\ (z-0.4)}$$

(c) Find inverse z-Transform of 10

$$x(z) = \frac{1-\frac{1}{2}z^{-1}}{1+\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}} \quad |z|>\frac{1}{2}$$

NST / Sem V (CBSGS) / Applications of Microcontroller
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Q.P. Code : **5612**

(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 .

1 (a) Define and explain evolution of Microprocessor. 5
(b) Draw and explain block diagram of 8051 microcontroller. 5
(c) Explain Timer 2 as a Baud Rate generator. 5
(d) Write a program to convert 9CH hexadecimal number to decimal. 5

2 (a) Assume that the 8051 serial port is connected to the COM port of the IBM PC and on the PC we are using the Hyper Terminal program to send and receive data serially. P1 and P2 of the 8051 are connected to LEDs and switches respectively. Write an 8051 program to
(i) Send to the PC the message "We Are Ready",
(ii) Receive any data sent by the PC and put it on LEDs connected to P1 and
(iii) Get data on switches connected to P2 and send it to the PC serially.
The program should perform part (i) once but parts (ii) and (iii) continuously. Use the 4800 baud rate. 10
(b) Explain the architecture of MCS 151 microcontroller. 10

3 (a) Interface Washing machine with 8051 microcontroller and write a program as per following machine operation - 10
(i) Water level select- low, medium, high.
(ii) Water inlet- hot, normal water knob.
(iii) Program select- heavy, normal, light, dedicate.
(iv) Machine ON- indicator.
(v) Fill water- hot, normal water inlet.
(vi) Agitation control- motor rotate in clock direction, motor rotate in anticlock direction.
(vii) Drain- drain valve open.
(viii) Spin- spin motor ON/OFF.
(ix) Washing complete-indication.
(b) Write a short note on Port Structure used in 8051 microcontroller. 10

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4. (a) Draw and explain the interfacing of Analog to Digital Conversion (ADC) with 8051 and write a program code to show this conversion. 10

(b) Write assembly language program to generate a square wave with an ON time of 3ms and an OFF time of 10ms on all pins of port0. Assume XTAL of 22 MHz. 10

5. (a) Interface 7-segment display with 8051 and write a program to display 0-9 counter with a predetermined delay. 10

(b) Give comparison between SPI and I^2C. 5

(c) State characteristics of RISC architectures. 5

6. (a) In a semester, a student has to take six courses. The marks of the student (out of 25) are stored in RAM locations 47H onwards. Write a program to find the average marks and output it on port1 using 8051 microcontroller. 10

(b) The data pins of an LCD are connected to P1. The information is latched into the LCD whenever its Enable pin goes from high to low. Write an 8051 C program to send "INSTRUMENTATION ENGG" to this LCD. 10

Sem-V - CBSGS) - INST- Controls System Design - Nov-15.

QP Code : **5696**

(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** if **needed.**

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1. Answer the following:-
   (a) Explain the need of compensator.
   (b) State advantages of modern control over traditional cntrol system.
   (c) Obtain transfer function using state model.

$$\dot{x}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}x+\begin{bmatrix}0\\ 1\end{bmatrix}u, \quad Y=\begin{bmatrix}1 & 0\end{bmatrix}x.$$

   (d) Derive the transfer function of lead compensator

2. (a) Construct state models of the following 10

   (i) $T(S)=\dfrac{S+2}{S^3+5S^2+6S+7}$

   (ii) $\dfrac{d^3y}{dt^3}+5\dfrac{d^2y}{dt^2}+7\dfrac{dy}{dt}+4y=3\dfrac{du}{dt}+4u$ 10

   (b) Explain design steps of lag compensator using root locus.

3. (a) A unity feedback type 2 system with $G(S)=\dfrac{K}{S^2}$. It is desired to Compensate the system so as to meet the following transient specifications. 10

$t_s \leq 4$ sec

$\%\ Mp \leq 20\%$

   (b) State controllability and observability. Check following system is controllable or observable? 10

$$\dot{x}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u$$

$$y=\begin{bmatrix}3 & 4 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

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$$\dot{x} = \begin{bmatrix} 1 & 2 & 0 \\ 3 & -1 & 1 \\ 0 & 2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

The desired poles are $-4, -3 \pm j$

(b) Find STM where, $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$ and obtain homogeneous response when initial conditions $X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ 10

5. (a) For the plant $G(S) = \dfrac{10(S+10)}{S(S+3)(S+12)}$

Give steps to be used to design the phase variable feedback gain to yield 5% over shoot and peak time 0.3 sec. Find the state feedback gain vector. 10

(b) A unity feedback system with an open loop T.F. $G(S) = \dfrac{k}{S(S+1)}$ where 10

$K_v = 12$ / sec

$\Phi_m = 40^0$

Design suitable compensator.

6. (a) Explain design steps for lead compensator using bode plot. 10
(b) Design PID controller for the system 10

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

Determine compensated block $G_c(S)$

INST/Sem-V(CBSGS)/Signal Conditioning Circuit Design

Q.P. Code : 5653

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

Note : 1. Question no. 1 is compulsory

2. Attempt any three questions from remaining five questions

3. Figures to the right indicate full marks

4. Assume suitable data whenever necessary

Duration : 03 hours Marks : 80

Q.1. a. With a suitable diagram discuss the concept of loading and how to avoid it. 20

b. Draw the circuit of practical Integrator and its output waveforms.

c. Draw the circuit of Zero crossing detector and its output waveforms.

d. Explain the significance of all-pass filters.

Q.2. a. Explain successive approximation analog to digital converter with diagram. 10

b. Draw and explain circuit diagram of absolute value circuit using op-amp. Discuss its advantages over traditional diode rectifier. 10

Q.3. a. Draw and explain the operation of Temperature compensated Log amplifier. 10

b. What are the advantages of active filters over passive filters. Design a second-order band pass filter for given F_H=2KHz, F_L=300Hz and Pass band gain=4. 10

Q.4. a. Design and Explain operation of Astable Multivibrator using IC555 for 60% duty cycle. 10

b. A sensor outputs a range of 20.0 to 250mVas a variable varies over its range. Develop signal conditioning so that this becomes 0 to 5V. The circuit must have very high input impedance. 10

Q. 5. A RTD has α[]=0.005/°C, R=500Ω, and a dissipation constant of PD=30mW/°C at 20°C. The RTD is used in a bridge circuit with $R_1 = R_2 = 500\Omega$ and R_3 a variable resistor used to null the bridge. If the supply is 10 V and the RTD is placed in a bath at 0°C, find the value of R_3 to null the bridge. 10

b. Draw and explain the principle and construction of thermocouple. What is the signal conditioning associated with it. 10

Q.6: Write short notes on : (any four) 20

a. Sample and hold circuit

b. Phase Locked loop

c. Variable voltage regulator

d. Data Acquisition System

e. Flash type ADC

f. SMPS

TE (SEM V) - IMST - CBSGS - CSC - NOV-15

QP Code : 5570

Duration: 03 Hours. Total marks assigned to the paper: 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.

Q. 1 Explain any **Four** **20**

a) Describe working of solenoid valve.

b) Write a short note on RFID and its applications

c) Distinguish between pneumatics, hydraulics and electrical systems

d) Distinguish between 2-wire and 4-wire transmitter

e) What is time delay valve

Q.2 a) Draw and explain hydraulic actuator speed control circuits in short **10**

b) Draw and explain types of compressors with their application **10**

Q.3 a) Write a short note on SMART transmitters with one application **10**

b) Explain working of safety valve, relief valve and rupture disc . **10**

Q. 4 a) How I to P convertor works and mention its significance in industry **10**

b) Draw and explain flapper nozzle mechanism **10**

Q.5 a) Write note on linear actuators and explain single acting and double acting cylinder **10**

b) What is a control valve? State the principle of operation and mention its types. **10**

Q.6 a) What is valve positioner? Explain it with help of a diagram **10**

b) Write a short note of air distribution system. **10**

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