sem-V / choice based / **Paper / Subject Code: 32501 / Signals and Systems** / May-2019
INST.

[Time: 3 Hours] **[Marks:75]**

N.B.: 1. Question No.1 is compulsory.
2. Attempt any three from remaining five questions.
3. Assume suitable data if any required.

Q.1 Solve **any four** 20

a) State and prove the convolution property of Fourier transform.

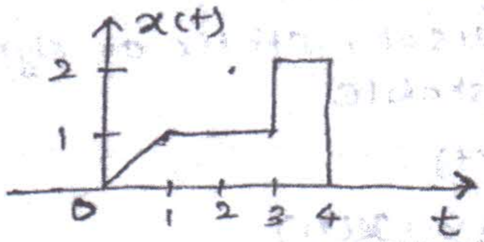
b) Determine initial and final value of x(n) If $x(z) = \frac{z}{z^2 - \frac{3}{2}z + \frac{1}{2}}\ |z| > \frac{1}{2}$

c) State and prove the parsaval theorem.

d) Explain Gibb's phenomenon.

e) Sketch one sided and both sided magnitude and phase spectra
$X(t) = 4 + 6\sin\left(4\pi t - \frac{\pi}{3}\right) + 8\cos\left(8\pi t - \frac{\pi}{4}\right)$

Q.2 a) Express the following signal in functional from. 05



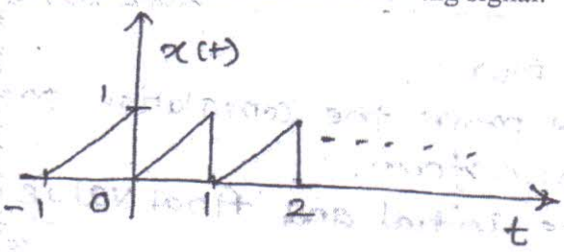
b) Whether the following signal in energy or power. Also find its energy or power x(n)= u(n) 05

c) Obtain the convolution of two continuous signal given below. Also sketch the result. 10

x(t)=1 for $0 \le t \le 1$
0 otherwise

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

Q.3 a) Find the exponential Fourier series coetticient of following signal. 10



b) Given $\frac{d^2y(t)}{dt^2} + \frac{8dy(t)}{dt} + 15y(t) = 3\,x(t)$ determine **10**

i) Impulse response of system.

ii) Response to the input $x(t) = 2e^{-3t}u(t)$

Q.4 a) Find the z-transform of x (z) by using p. f. $x(z) = \frac{z}{z^2+z+1}$ **10**

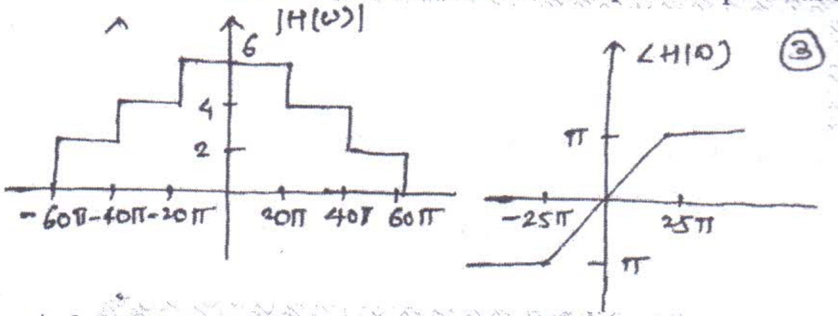
b) Find the following systems are linear / nonlinear, time variant /invariant, causal / noncausal, static or dynamic, stable or unstable. **10**

$y(+) = t\,x(t)$

$y(n) = \cos wn\, x(n)$

Q.5 a) Final the inverse Laplace transform for all passible roc condition. $X(s) = \frac{s+3}{(s+1)(s+4)^3}$ **10**

b) Consider the following system with magnetude and phase response as shown in figure. **05**



Find the o/p for the input $x(t) = 4\sin(30\pi t) + 6\cos\left(50\pi t + \frac{\pi}{3}\right)$

c) Find the fourier transform of signum function. **05**

Q.6 Obtain **10**

i) Z –transform of

$x(n) = n\left(\frac{1}{4}\right)^n u(n) + u(n-1)$

ii) Laplace transform of

$X(t) = te^{-4t}u(t) + tu(t+1)$

A discrite time LTI system is specified by $y(n) = -7y(n-1) - 12y(n-2) + 4x(n-1) - 2x(n)$ where $y(-1) = -2$ $y(-2) = 3$. Determine **10**

i. Zero in put response

ii. Zero state response where $x(n) = u(n)$

iii. Total response.

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m-V Paper / Subject Code: 32502 / Applications of Microcontroller May-2019
Choice Based / INST

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.
(4) Figure to the right indicates full marks.

Q. 1 Answer the following questions. (Attempt any **FIVE**) **20**
a) Explain bit addressable memory of 8051.
b) Give the function of following Instruction-
i) CJNE A, #45H,12H, ii) MOVC A, @A+DPTR.
c) Differentiate between timer and counter operation of 8051.
d) Explain the Difference between Microprocessor and Microcontroller.
e) Interface LED to 8051 microcontroller. Write a program to toggle LED.
f) Explain Power Saving and Power Down mode.

Q. 2 a) Draw and explain the Architecture of 8051 microcontroller **10**
b) What is Embedded system? Explain the design metrics of Embedded system. **10**

Q. 3 a) Write an assembly language program to convert two ASCII numbers into packed BCD Number. **10**
b) Explain the addressing mode of 8051 microcontroller with example. **10**

Q. 4 a) Write a program to transmit message "INSTRUMENTATION" serially at 9600 baud rate. **10**
b) Draw and Explain the interface of LCD. Write a program to display "Good Morning" on this display. **10**

Q.5 a) Interface 7 Segment Display with 8051 and write a program to display 0-9 counter with predetermined delay. **10**
b) Interface DAC with 8051 microcontroller and write a program to generate square wave continuously. **10**

Q.6 a) Explain the automatic washing machine system by using 8051 microcontroller. **10**
b) Explain the interrupt structure of 8051 microcontroller in details. **10**

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IV Choice Base **Paper / Subject Code: 32503 / Control System Design** / MAY 2019
INST

Duration: 3 Hours **Max. Marks 80**

N.B.

1. **Q.1** is compulsory. Attempt **any three** from the remaining questions.
2. All questions carry equal marks.
3. Figures to the Right indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt **any four** **20**

a. Obtain the state space representation for following system in diagonal form

$$G(s) = \frac{1}{s^2 + 0.3s - 0.02}$$

b. Obtain the transfer function for the following system.

$$\begin{aligned} \dot{x} &= \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \\ y &= [1\ 0]\, x \end{aligned}$$

c. Explain PD compensator. Why it is required? Draw a typical circuit diagram for PD compensator.

d. Define controllability and stabilizability.

e. For the system

$$G(s) = \frac{s+1}{s(s+3)}$$

check if $s = -2$ pole is on root locus or not.

f. Write Cayley Hamilton theorem. Check if it holds for the matrix $F = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$.

Q.2 A. Check for the controllability and observability of the system, **10**

$$\begin{aligned} \dot{z}_1 &= -z_1 + u \\ \dot{z}_2 &= -2z_2 + z_3 \\ \dot{z}_3 &= -2z_3 + u \\ y &= z_1 + z_3 \end{aligned}$$

using Kalman's tests.

B. Represent the system transfer function **10**

$$G(s) = \frac{s + 0.5}{s^2 + 3s + 2}$$

in **(i)** controllable canonical form **(ii)** diagonal form.

Q.3 A. Design the lag compensator using root-locus for the system **10**

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

such that dominant closed loop poles are at $s_d = -1.91 \pm j1.78$.

B. Write the steps to design lead compensator using Bode plot. **10**

Q.4 A. Design the state feedback control for the system **10**

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -1.32 & 2.32 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

to place the poles at $-1, -2$.

B. Obtain $x(t)$ for the system **10**

$$\dot{x} = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \mathrm{u}$$

if initial condition is $x(0) = [1 \ 1]^{\top}$.

Q.5 A. Prove the non-uniqueness of state space representation using similarity transformation. Also prove that eigenvalues of system are invariant under linear transformation. **10**

B. A system is given by **10**

$$\begin{aligned} \dot{x} &= \begin{bmatrix} -4 & 1 \\ -3 & 0 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u \\ y &= [1 \ 0] x \end{aligned}$$

Design the observer that has poles at $-12, -15$.

Q.6 Write short notes on **20**

A. Ziegler-Nichols method for PID controller tuning.

B. Lag-lead compensator.