CMR INSTITUTE OF TECHNOLOGY

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Online Internal Assesment Test - II

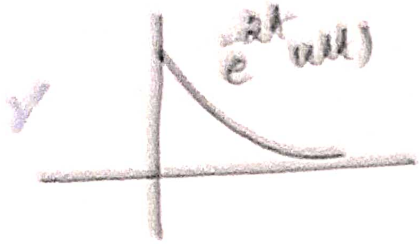
Sub:	SIGNALS AND SYSTEMS							Code:	18EE54
Date:	02/11/2020	Duration:	90 mins	Max Marks:	50	Sem:	5th	Branch:	EEE

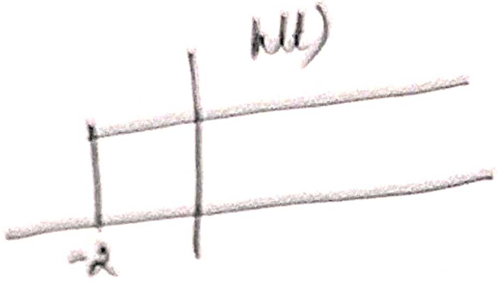
Answer Any FIVE FULL Questions

		Marks	OBE CO	OBE RBT
1	If $h(t)=e^{-2t}u(t)$ and $x(t)=u(t+2)$, Determine the output y(t) given h(t) is the impulse response and $x(t)$ is the input for the LTI system.	10	CO3	L3
2	The impulse response of a system 1 is $h(t) = e^{2t}u(t-1)$ and system 2 is $h(t)=e^{-2\|t\|}$.Evaluate the properties (causality and stability)satisfied by system 1 and system 2	10	CO4	L2
3	Obtain direct form-1 and direct form 2 representations for the following a. y[n]+¼ y[n-1]-¾y[n-2]=x[n] +x[n-1] b. y[n]+0.5y[n-1]-0.3y[n-3]=x[n] +2x[n-2]	10	CO4	L2
4	Find the natural response, forced response and complete response of the given difference equation. y[n]+1.5y[n-1]+0.5y[n-2]=x[n] given y[-1]=1, y[-2]=0, $x[n]=2^n u[n]$	10	CO4	L3
5	Find the natural response, forced response and complete response of the given difference equation. $\ddot{y}(t)+5\dot{y}(t)+6y(t)=2e^{-t}u(t)$ with $y(0)=0,\ \dot{y}(0)=1$.	10	CO4	L3
6	Consider an input x(n) and a unit impulse response h(n) given by $x(n)=\alpha^n u(n)$ and h(n)=u(n); 0< α<1.Obtain the convolution sum y(n).	10	CO3	L3
7	Compute the convolution sum of the 2 sequences, $x_1[n]$ and $x_2[n]$, given below. $x_1[n] = (1, 2, \underset{\Uparrow}{3})$, $x_2[n] = (\underset{\Uparrow}{2}, 1, 4)$ Also verify the results with tabular method.	10	CO3	L3

IAT-2

① $x(t) = e^{-2t}u(t)$ $\quad h(t) = u(t+2)$





case(i) $t+2<0$ No overlapping $y(t)=0$

case(ii) $t+2>0$

$$y(t) = \int_0^{t+2} e^{-2\tau}\,d\tau = \frac{1}{2}\left[1 - e^{-2(t+2)}\right]$$

$$= \frac{1}{2}\left[1 - e^{-2t} - e^{4}\right]$$

$$= \frac{1}{2} - \frac{1}{2}e^{-2t} - \frac{1}{2}e^{4}$$

② $h(t) = e^{-2|t|}$

(i) Not memoryless

(ii) $h(t) \neq 0$ $t<0$ Non causal

(iii) stable or not

$$S = \int_{-\infty}^{\infty} |h(t)|\,dt = \int_{-\infty}^{0} e^{2t}\,dt + \int_{0}^{\infty} e^{-2t}\,dt = 1$$

stable

$h(t) = e^{2t}\, u(t-1)$

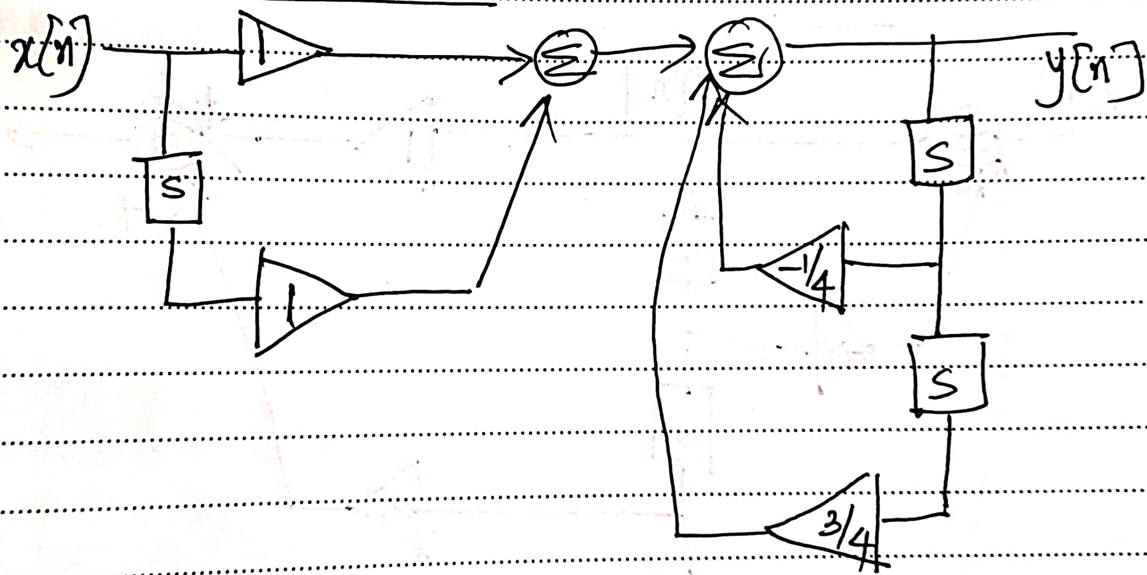
→ Memoryless [Not in form $h(t) = C\delta(t)$]

→ Causal since $h(t) = 0 \quad t<0$

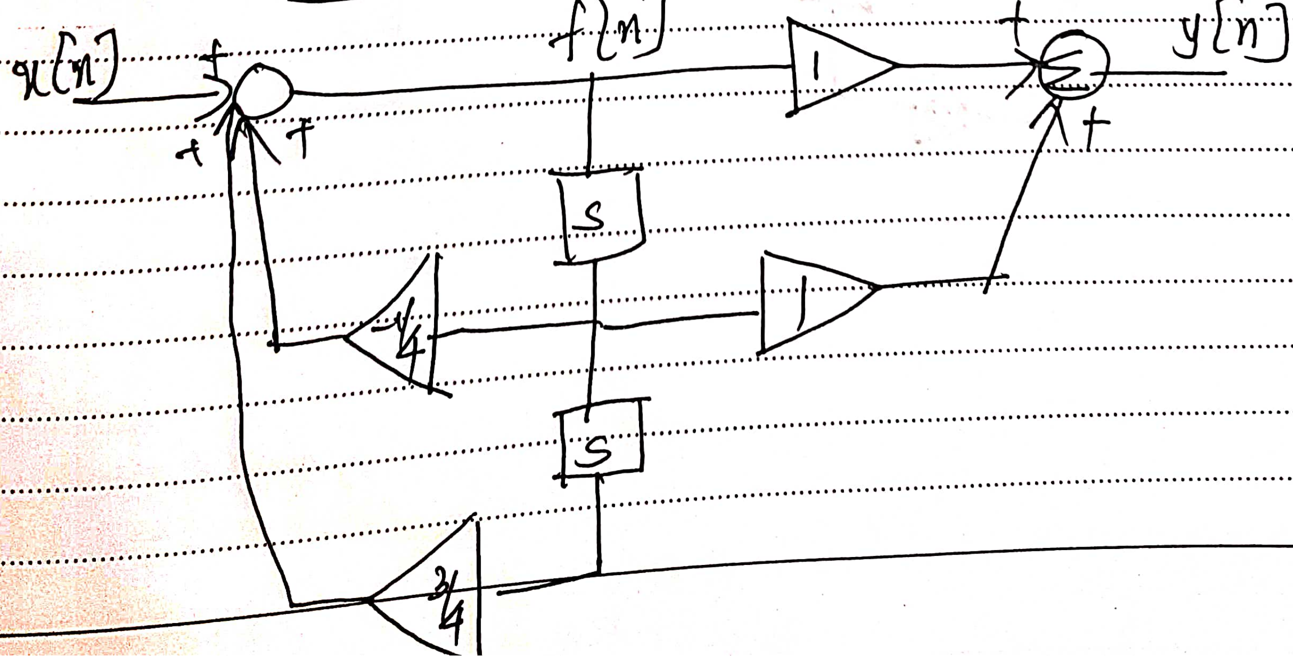
→ $S = \int_{1}^{\infty} e^{2t}\, dt = \infty$ **Unstable**

(3)

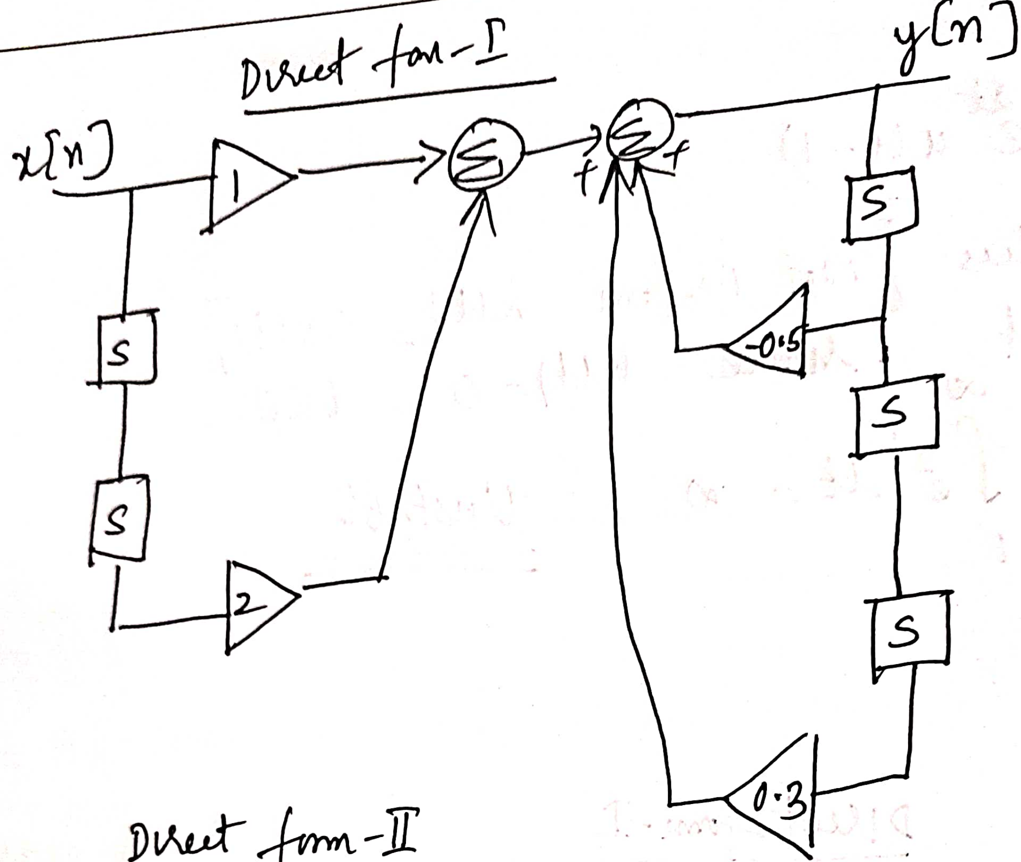
(a) Direct form-I



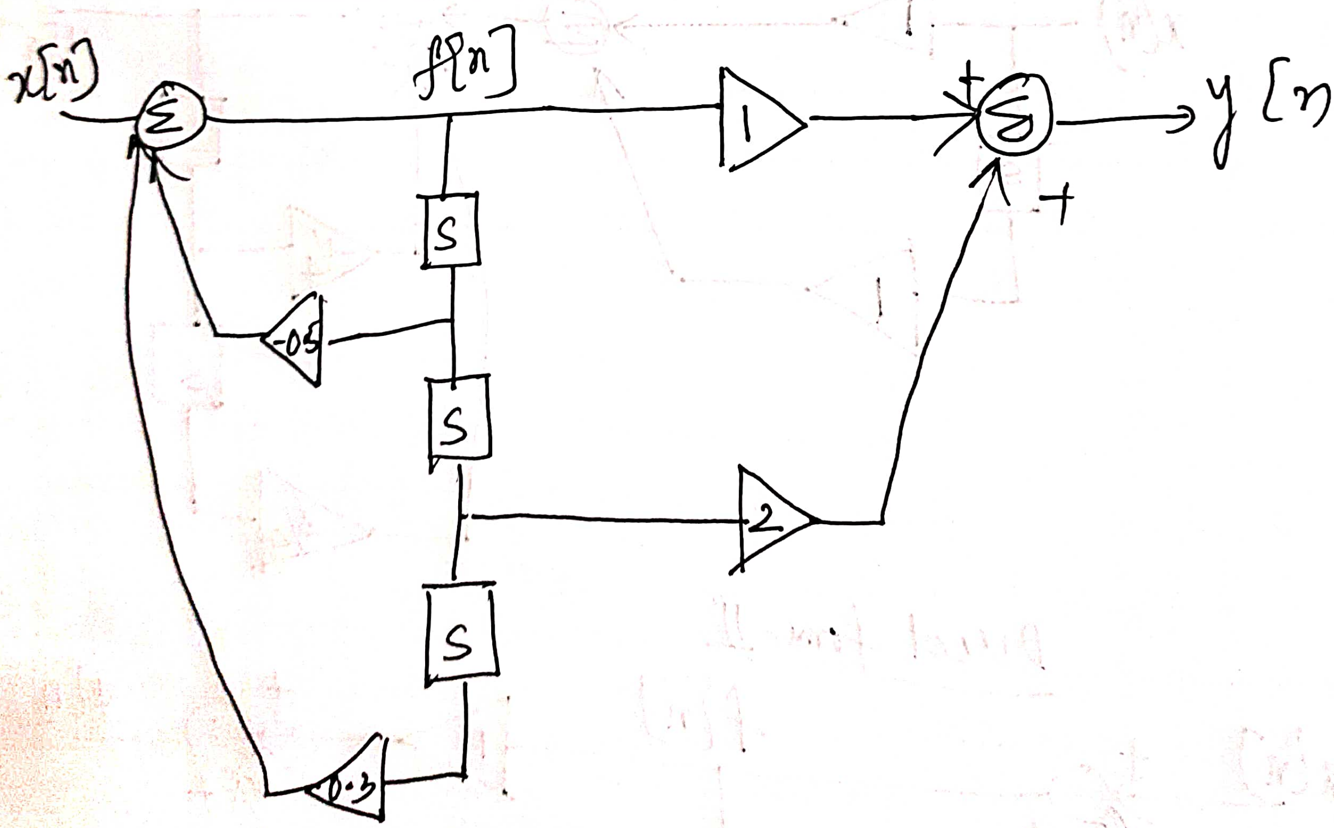
Direct form-II



Direct form-I



Direct form-II



Experiment No.

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(4) $y[n] + 1.5y[n-1] + 0.5y[n-2] = x[n]$

$y[-1] = 1 \quad y[-2] = 0 \quad x[n] = 2^n u[n]$

$r_1 = 1 \quad r_2 = 0.5$

$c_1 + c_2 = 1.5$

$c_1 + 0.5c_2 = 1.75$

$c_1 = 2 \quad c_2 = -0.5$

$$\boxed{y^n[n] = 2u[n] - 0.5[0.5]^n u[n]}$$

$$y^p[n] = \frac{8}{3}[2]^n u[n]$$

$$y^f[n] = \left[-2 + \frac{1}{3}[0.5]^n + \frac{8}{3}(2)^n\right]u[n]$$

$$y[n] = y^n[n] + y^f[n] = \left[\frac{-1}{6}(0.5)^n + \frac{8}{3}2^n\right]u[n]$$

⑤ $\ddot{y}(t) + 5\dot{y}(t) + 6\,y(t) = 2e^{-t}u(t)$ $\quad y(0) = 0$

$y'(0) = 1$

$s^2 + 5s + 6 = 0$ $\quad K_1 + K_2 = 0$

$-3K_1 - 2K_2 = 1$

$y^h(t) = -e^{-3t} + e^{-2t}$ $\quad y^p(t) = e^{-t}$

$y^f(t) =$ $\quad y^f(t) = e^{-3t} - 2e^{-2t} + e^{-t}$

$$\boxed{y(t) = e^{-t} - e^{-2t}}$$

⑥ $x[n] = \alpha^n u[n]$ $\quad h[n] = u[n]$

$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]\,h[n-k]$$

$$= \sum_{k=-\infty}^{\infty} \alpha^k u(k)\,u[n-k]$$

$$= \sum_{k=0}^{n} \alpha^k = \frac{\alpha^{n+1} - 1}{\alpha - 1}$$

⑦ $x_1[n] = (1, \underset{\uparrow}{2}, 3)$ $x_2(n) = (2, \underset{\uparrow}{1}, 4)$

$x_2[n]$ \ $x_1[n]$	1	2	3
2	2	4	6
1	1	2	3
4	4	8	12

$$y[n] = \left\{ 2,\ 5,\ \underset{\uparrow}{12},\ 11,\ 12 \right\}$$