

## [IT CookBook] 기초 신호 및 시스템

: 개념과 원리가 한눈에 보이는 200여 개의 풍부한 예제

### [연습문제 답안 이용 안내]

- 본 연습문제 답안의 저작권은 한빛아카데미(주)에 있습니다.
- 이 자료를 무단으로 전제하거나 배포할 경우 저작권법 136조에 의거하여 최고 5년 이하의 징역 또는 5천만원 이하의 벌금에 처할 수 있고 이를 병과(併科)할 수도 있습니다.

## Chapter 04 연속 시스템의 시간 영역 해석

### [Quick Review]

- [1] Ans) ○
- [2] Ans) 인과성
- [3] Ans) ○
- [4] Ans) ×
- [5] Ans) ○
- [6] Ans) 곱
- [7] Ans) 같은
- [8] Ans) 컨벌루션
- [9] Ans) 합
- [10] Ans) ×
- [11] Ans) 합
- [12] Ans) ○
- [13] Ans) ○
- [14] Ans) ×
- [15] Ans) 적분
- [16] Ans) ×
- [17] Ans) ○

[18] *Ans)* 특이해

[19] *Ans)* ○

[20] *Ans)* ○

## [기초 문제]

### 4.1

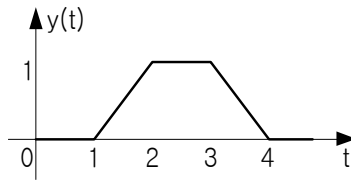
Ans)

- (a) 인과 시스템, 안정한 시스템
- (b) 인과 시스템, 불안정한 시스템

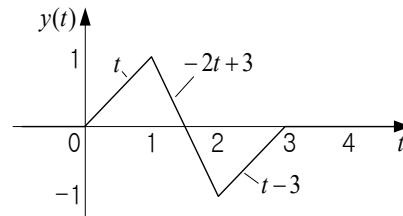
### 4.2

Ans)

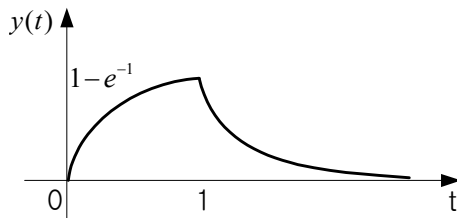
- (a)  $y(t) = (t-1)u(t-1) - (t-2)u(t-2) - (t-3)u(t-3) = (t-4)u(t-4)$
- (b)  $y(t) = tu(t) - 3(t-1)u(t-1) + 3(t-2)u(t-2) - (t-3)u(t-3)$



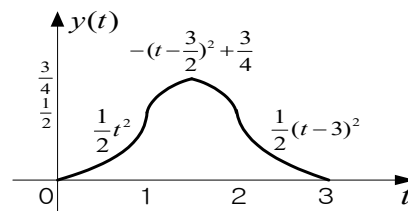
(a)



(b)



(c)

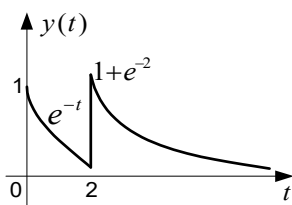


(d)

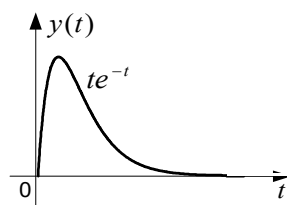
### 4.3

Ans)

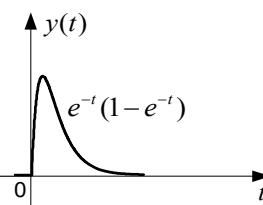
- (a)  $y(t) = e^{-t}u(t) + e^{-(t-2)}u(t-2)$
- (b)  $y(t) = te^{-t}u(t)$
- (c)  $y(t) = e^{-t}(1-e^{-t})u(t)$



(a)



(b)



(c)

#### 4.4

Ans)

- (a) 안정한 시스템
- (b) 불안정한 시스템
- (c) 안정한 시스템

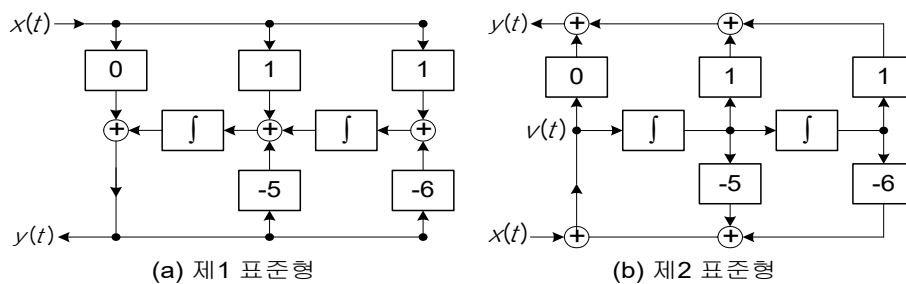
#### 4.5

Ans)  $(h_1(t) * h_3(t) + h_5(t)) * h_5(t) + h_1(t) * h_2(t)$

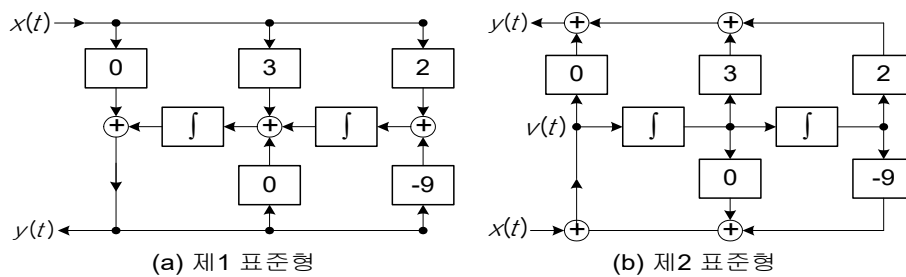
#### 4.6

Ans)

- (a) 특성방정식 :  $\lambda^2 + 5\lambda + 6 = (\lambda + 2)(\lambda + 3) = 0$ , 안정한 시스템



- (b) 특성방정식 :  $\lambda^2 + 9 = (\lambda + j3)(\lambda - j3) = 0$ , 임계 안정(불안정)한 시스템



#### 4.7

Ans)

- (a)  $y(t) = -e^{-t} + 1$
- (b)  $y(t) = -2e^{-t} + e^{-2t} + 1$

#### 4.8

Ans)

- (a)  $y(t) = e^{-t} + 1$
- (b)  $y(t) = e^{-t} + te^{-t}$
- (c)  $y(t) = 2e^{-t} - e^{-2t}$
- (d)  $y(t) = 3e^{-t} + te^{-t} + 2$

4.9

Ans)

(a)  $y(t) = e^{-t} - e^{-2t} + 1$

(b)  $y(t) = 4e^{-t} - 4e^{-3t} + e^{-3t}$

4.10

Ans)

- (a) 안정한 시스템
- (b) 안정한 시스템
- (c) 불안정한 시스템
- (d) 불안정한 시스템

## [응용 문제]

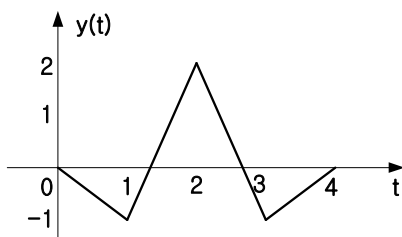
### 4.11

Ans)

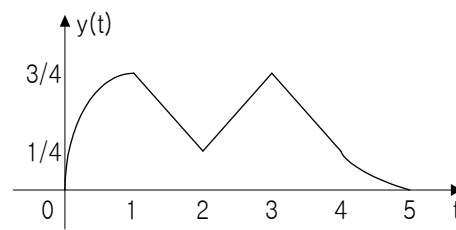
$$\begin{aligned} \text{(a)} \quad 0 \leq t < 1 & : y(t) = -t \\ 1 \leq t < 2 & : y(t) = 3t - 4 \\ 2 \leq t < 3 & : y(t) = -3t + 8 \\ 3 \leq t < 4 & : y(t) = t - 4 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 0 \leq t < 1 & : y(t) = -\frac{1}{4}t^2 + t \\ 1 \leq t < 2 & : y(t) = -\frac{1}{2}t + \frac{5}{4} \\ 2 \leq t < 3 & : y(t) = \frac{1}{2}t - \frac{3}{4} \\ 3 \leq t < 4 & : y(t) = -\frac{1}{2}t + \frac{9}{4} \\ 4 \leq t < 5 & : y(t) = \frac{1}{4}t^2 - \frac{5}{2}t + \frac{25}{4} \end{aligned}$$

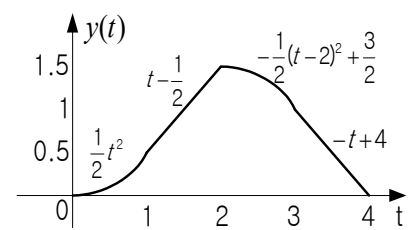
$$\begin{aligned} \text{(c)} \quad 0 \leq t < 1 & : y(t) = \frac{1}{2}t^2 \\ 1 \leq t < 2 & : y(t) = t - \frac{1}{2} \\ 2 \leq t < 3 & : y(t) = -\frac{1}{2}(t-2)^2 + \frac{3}{2} \\ 3 \leq t < 4 & : y(t) = -t + 4 \end{aligned}$$



(a)



(b)



(c)

### 4.12

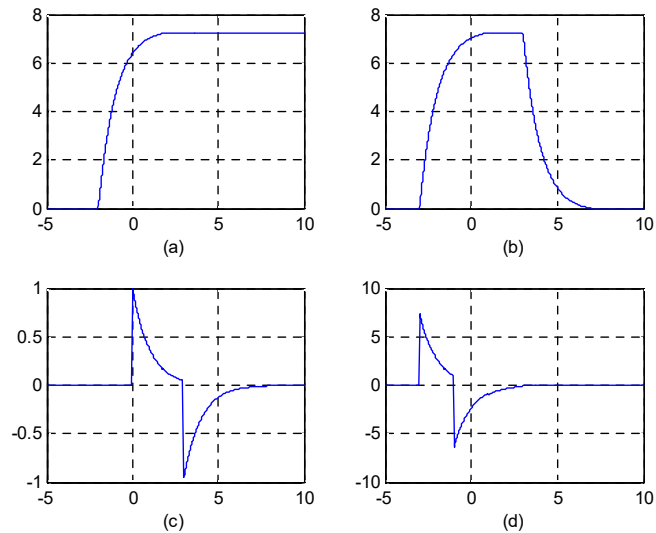
Ans)

$$\begin{aligned} \text{(a)} \quad -3 \leq t < -1 & : y(t) = e^{-(t+1)} \\ -1 \leq t \leq 1 & : y(t) = e^{-t}(e^{-1} - e^1) \\ 1 < t \leq 3 & : y(t) = -e^{-(t-1)} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad -2 \leq t < 2 & : y(t) = e^2(1 - e^{-(t+2)}) \\ t \geq 2 & : y(t) = e^2(1 - e^{-4}) \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad -3 \leq t < 1 & : y(t) = e^2(1 - e^{-(t+3)}) \\ 1 \leq t < 3 & : y(t) = e^2(1 - e^{-4}) \\ 3 \leq t < 7 & : y(t) = e^{-2}(e^{-(t-7)} - 1) \end{aligned}$$

※ 아래 그림에서 (a)는 삭제, (d)가 (a)임



#### 4.13

Ans)

(a) BIBO 불안정

(b)  $y(t) = \int_0^t x(\tau) d\tau$ , 즉 이 시스템은 적분기이다.

#### 4.14

Ans)

$$\text{(a)} \quad y(t) = \frac{1}{3}e^{-3t} - \frac{1}{2}e^{-4t} + \frac{1}{6}$$

$$\text{(b)} \quad y(t) = \frac{1}{2}e^{-3t} - \frac{2}{3}e^{-4t} + \frac{1}{6}e^{-t}$$

$$\text{(c)} \quad y(t) = 2e^{-3t} - 2e^{-4t} - te^{-3t}$$

#### 4.15

Ans)

$$\text{(a)} \quad y(t) = e^{-2t} + 4te^{-2t} + 1$$

$$\text{(b)} \quad y(t) = -2e^{-2t} + 2te^{-2t} + 4e^{-t}$$