# EE 200: Mid-Sem
# Duration 2 Hrs.

Use the following format of answering:

**Name:** **Roll No:** **Section:**

**Email:** **WhatsApp no:**

*Write **only** the final answer in each question. All questions carry equal marks. Answer scripts sent after 120 minutes will be penalized with negative marks. The submission channel will be closed at completion of 120 minutes.*

1. Consider the N-degree polynomial given by

   $$P(s) = s^N + a_{N-1}s^{N-1} + ... + a_{N-k}s^{N-k} + ... + a_1 s + a_0$$

   Given that the roots of the polynomial P(s) are $\{s_1, s_2, ..., s_N\}$, express the coefficient $a_{N-k}$ in terms of the root $s_i$.

2. Determine and sketch the even and odd parts of the signal in Fig.1.

3. Develop an equivalent representation of the system in Fig.2 by applying the transpose operation.

4. Two signals g(t) and h(t) are shown in Fig.3. Evaluate and sketch the result obtained by convolution of g(t) with h(t).

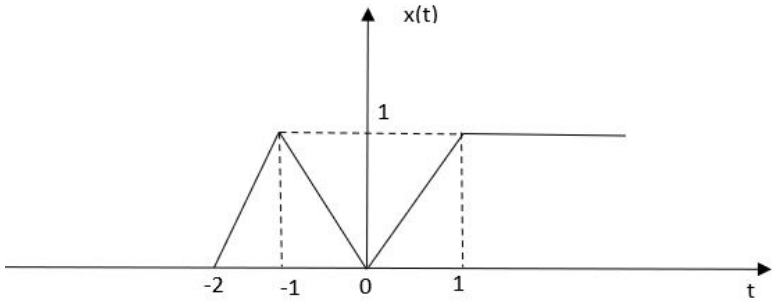


Figure 1: Diagram for Question 2

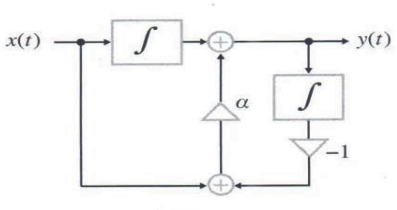


Figure 2: Diagram for Question 3

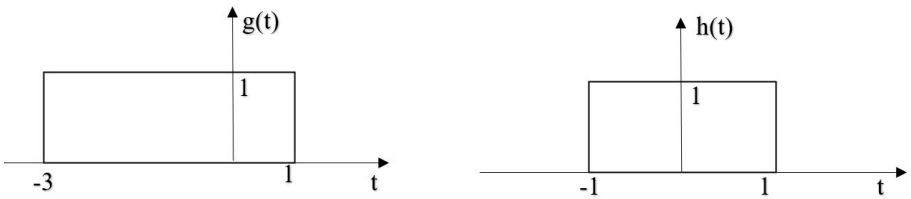


Figure 3: Diagram for Question 4

5. An LTI system produces output,

$$y(t) = \int_{-\infty}^{t+t_0} x(\tau)d\tau, t_0 > 0$$

for any signal x(t)
(i) Find its impulse response h(t).
(ii) Is the system stable?
(iii) Is the system causal?

6. The impulse response of a causal LTI system is given by $h(t) = \delta(t)+2e^{-2t}\mu(t)$. Find the impulse response $h^{-1}(t)$ of the inverse system.

7. Given that

$$p(t) = \begin{cases} \cos(8\pi t) \ ; & \frac{-1}{2} \leq t \leq \frac{1}{2} \\ 0 \ ; & \text{otherwise} \end{cases}$$

determine $P(j\Omega)$

8. The input and output signals of a causal LTI system are respectively, $x(t) = 2e^{-3t}\mu(t)$ and $y(t) = 2.5e^{-2t}\mu(t)$. Determine the frequency response $H(j\Omega)$ and the impulse response h(t) of the system.

9. Find $H(j\Omega) = Y(j\Omega)/X(j\Omega)$ for the system described by the integral-differential equation:

$$\frac{d^2y(t)}{dt^2} - \int_{-\infty}^{t} y(\tau)e^{-(t-\tau)}d\tau = x(t)$$

10. The sinusoidal signal $\tilde{x}(t) = 5\cos(20t + 0.3)$ is the input to the causal LTI system given by

$$H(j\Omega) = \frac{2(j\Omega) + 3}{j\Omega + 6}$$

Find the steady state output of the system.