

**Q.2 a. Discuss basic system properties with the help of two examples of each.**  
(i) causality  
(ii) stability

**Answer:** (i) See article 1.6.3 of Text Book I  
(ii) See article 1.6.4 of Text Book I

**Q.2 b. Show that system represented by  $y(t) = t x(t)$  is linear** (4)

**Answer:** See example 1.17 of Text Book I

**Q.2 c. Write short note on convolutional Integral.** (4)

**Answer:**

**Q.3 a. Discuss the following properties of continuous time fourier series with the help of one example in each:** (10)  
(i) Time shifting  
(ii) Multiplication

**Answer:** (i) See article 3.5.2 of Text Book I  
(ii) See article 3.5.5 of Text Book I

**Q.3 b. Determine complex exponential fourier series representation of**  
(i)  $x(t) = \cos \omega_0 t$   
(ii)  $x(t) = \cos 3t + \sin 6t$

**Answer:**

**Q.4 a. Determine fourier transform of the signal.**  
 $x(t) = e^{-a|t|}$ ;  $a > 0$

**Answer:** See example 4.2 of Text Book I

**Q.4 b. State and prove the Parseval's Relation for continuous – Time fourier transform using suitable example.**

**Answer:** See article 4.3.7 of Text Book I

**Q.5 a. Determine fourier transform of  $X(e^{j\omega})$  of the unit step  $x[n] = u[n]$  using accumulation property.** (6)

**Answer:** See example 5.8 of Text Book I

- Q.5** b. **Explain the following properties of Discrete-time Fourier Transform.**  
 (i) **Differentiation in frequency**  
 (ii) **Duality**

**Answer:** (i) See article 5.3.8 of Text Book I  
 (ii) See article 5.7 of Text Book I

- Q.6** a. **State and explain Time Domain & frequency-Domain aspects of non-ideal filters.** (8)

**Answer:** See article 6.4 of Text Book I

- Q.6** b. **Find Nyquist rate of the following signals:** (8)  
 (i)  $10 \text{ sinc}(5t)$   
 (ii)  $\text{sinc}^2(200t)$

**Answer:**

- Q.7** a. **Find Laplace Transform and its ROC of the following:** (8)  
 (i)  $x(t) = e^{-at}u(t)$   
 (ii)  $x(t) = 3e^{-2t}u(t) - 2e^{-t}u(t)$

**Answer:** (i) See example 9.1 of Text Book I  
 (ii) See example 9.3 of Text Book I

- Q.7** b. **Discuss following properties of Laplace Transform:** (8)  
 (i) **Linearity** (ii) **Time scaling**

**Answer:** (i) See article 9.5.1 of Text Book I  
 (ii) See article 9.5.4 of Text Book I

- Q.8** a. **Determine Z transform of the following:** (8)

(i)  $x[n] = 7\left(\frac{1}{3}\right)^n u(n) - 6\left(\frac{1}{2}\right)^n u(n)$

(ii)  $x[n] = \left(\frac{1}{3}\right)^n \sin\left(\frac{\pi}{4}n\right)u(n)$

**Answer:** (i) See example 10.3 of Text Book I

(ii) See example 10.4 of Text Book I

**Q.8 b. Show that the system represented by**

$$H(Z) = \frac{1}{1 - \frac{1}{2}Z^{-1}} + \frac{1}{1 - 2Z^{-1}}, |Z| > 2 \text{ is causal.}$$

**Answer:** See example 10.21 of Text Book I

**Q.9 Discuss the following: (4×4)**

- (i) Correlation functions
- (ii) Power spectral density (PSD)
- (iii) Ergodic processes
- (iv) Wide sense stationary (WSS) process

**Answer:** (i) See article 1.5 of Text Book II  
(ii) See article 1.9 of Text Book II  
(iii) See article 1.6 of Text Book II  
(iv) See article 1.4 of Text Book II

### TEXT BOOK

- I. Signals and Systems, A.V. Oppenheim and A.S. Willsky with S. H. Nawab, Second Edition, PHI Private limited, 2006.
- II. Communication Systems, Simon Haykin, 4<sup>th</sup> Edition, Wiley Student Edition, 7<sup>th</sup> Reprint 2007.