

2063
B.E. (Electronics and Communication Engineering)
Third Semester
EC-302: Signals and Systems

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section. Use of scientific calculator is allowed.

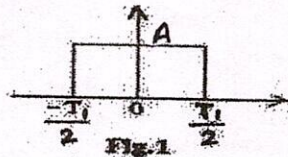
x-x-x

Q.1 Attempt all questions:-

- (a) Define Gibbs Phenomenon. (2)
- (b) Define continuous time unit step and unit impulse. (2)
- (c) Define Energy and power signal. (2)
- (d) What is the Aperture effect? (2)
- (e) State Time Shifting property in relation to Fourier series. (2)

Section- A

Q. 2(a) The average power of the following signal is: - (5)



(b) For signal $X(t)=2u(t+1)-2u(t-3)$ plot the following: (5)
i) $X(t+4)$ ii) $X(t-3)$

Q.3 (a) Consider the system: $Y(t)=x(t) \sin[w_0t]$. Determine whether system is: (5)
(i) Linear (ii) Stable (iii) Causal (iv) Time Invariant (v) Memoryless

(b) Compute the convolution $X_1(t)= \cos t u(t)$ and $X_2(t)= u(t)$. (5)

Q.4 (a) Find the Fourier transform of Unit step signal. (5)

(b) Explain Reconstruction of signals from its samples with neat diagrams. (5)

Section-B

Q.5 Using Laplace transform, find the forced response and the natural response of the system described by $\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + 6x(t)$. The initial conditions for the system are $y(0^-) = 1$ and $\left. \frac{dy(t)}{dt} \right|_{t=0^-} = 2$. Determine the two responses for a step input. (10)

Q.6 (a) Explain Region of convergence in Z-Transform. (5)

(b) Calculate Z-Transform of the $X(n)= n^2 u(n)$. (5)

Q.7 (a) Explain State transition matrix and its importance. (5)

(b) Find initial and final values of $X(s) = (s+4)/(s^2+3s+5)$. (5)

x-x-x

ET-1000 (Electronics) and ET-1000 (Electronics)
 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

Time: 1 hour

Q.1. The input signal is $x(t) = \cos(2t)$ and the output signal is $y(t) = \cos(2t - \frac{\pi}{4})$. Determine the phase shift of the system.

- (1) $\frac{\pi}{4}$ (2) $-\frac{\pi}{4}$ (3) $\frac{\pi}{2}$ (4) $-\frac{\pi}{2}$ (5) $\frac{3\pi}{4}$ (6) $-\frac{3\pi}{4}$ (7) $\frac{\pi}{8}$ (8) $-\frac{\pi}{8}$ (9) $\frac{3\pi}{8}$ (10) $-\frac{3\pi}{8}$

Section A

Q.2. The average power of the following signal is _____



(1) 0.5 (2) 1 (3) 1.5 (4) 2 (5) 2.5 (6) 3 (7) 3.5 (8) 4 (9) 4.5 (10) 5

Q.3. A system is described by the transfer function $H(s) = \frac{1}{s^2 + 2s + 2}$. The input signal is $x(t) = e^{-t} \cos(t)$. Determine the steady-state response $y(t)$.

- (1) $e^{-t} \cos(t)$ (2) $e^{-t} \sin(t)$ (3) $e^{-t} \cos(t - \frac{\pi}{4})$ (4) $e^{-t} \sin(t - \frac{\pi}{4})$ (5) $e^{-t} \cos(t + \frac{\pi}{4})$ (6) $e^{-t} \sin(t + \frac{\pi}{4})$ (7) $e^{-t} \cos(t - \frac{\pi}{2})$ (8) $e^{-t} \sin(t - \frac{\pi}{2})$ (9) $e^{-t} \cos(t + \frac{\pi}{2})$ (10) $e^{-t} \sin(t + \frac{\pi}{2})$

Section B

Q.4. Using Laplace transform, find the forced response and the natural response of the system described by $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 2y = \cos(t)$. The initial conditions are $y(0) = 0$ and $\dot{y}(0) = 0$.

(1) $y(t) = \frac{1}{2} \cos(t) - \frac{1}{2} \sin(t)$ (2) $y(t) = \frac{1}{2} \cos(t) + \frac{1}{2} \sin(t)$ (3) $y(t) = \frac{1}{2} \cos(t) - \frac{1}{2} e^{-t} \cos(t)$ (4) $y(t) = \frac{1}{2} \cos(t) + \frac{1}{2} e^{-t} \cos(t)$ (5) $y(t) = \frac{1}{2} \cos(t) - \frac{1}{2} e^{-t} \sin(t)$ (6) $y(t) = \frac{1}{2} \cos(t) + \frac{1}{2} e^{-t} \sin(t)$ (7) $y(t) = \frac{1}{2} \cos(t) - \frac{1}{2} e^{-t} \cos(t) - \frac{1}{2} e^{-t} \sin(t)$ (8) $y(t) = \frac{1}{2} \cos(t) + \frac{1}{2} e^{-t} \cos(t) - \frac{1}{2} e^{-t} \sin(t)$ (9) $y(t) = \frac{1}{2} \cos(t) - \frac{1}{2} e^{-t} \cos(t) + \frac{1}{2} e^{-t} \sin(t)$ (10) $y(t) = \frac{1}{2} \cos(t) + \frac{1}{2} e^{-t} \cos(t) + \frac{1}{2} e^{-t} \sin(t)$

Q.5. (a) Find the region of convergence for the transfer function $H(s) = \frac{1}{s^2 + 2s + 2}$. (b) Calculate the inverse Laplace transform of $H(s)$.

- (1) (a) $\text{Re}(s) < -1$ (b) $e^{-t} \cos(t)$ (2) (a) $\text{Re}(s) > -1$ (b) $e^{-t} \sin(t)$ (3) (a) $\text{Re}(s) < -1$ (b) $e^{-t} \cos(t - \frac{\pi}{4})$ (4) (a) $\text{Re}(s) > -1$ (b) $e^{-t} \sin(t - \frac{\pi}{4})$ (5) (a) $\text{Re}(s) < -1$ (b) $e^{-t} \cos(t + \frac{\pi}{4})$ (6) (a) $\text{Re}(s) > -1$ (b) $e^{-t} \sin(t + \frac{\pi}{4})$ (7) (a) $\text{Re}(s) < -1$ (b) $e^{-t} \cos(t - \frac{\pi}{2})$ (8) (a) $\text{Re}(s) > -1$ (b) $e^{-t} \sin(t - \frac{\pi}{2})$ (9) (a) $\text{Re}(s) < -1$ (b) $e^{-t} \cos(t + \frac{\pi}{2})$ (10) (a) $\text{Re}(s) > -1$ (b) $e^{-t} \sin(t + \frac{\pi}{2})$