

(3 Hours)

[Total Marks : 80

QP Code : 5497

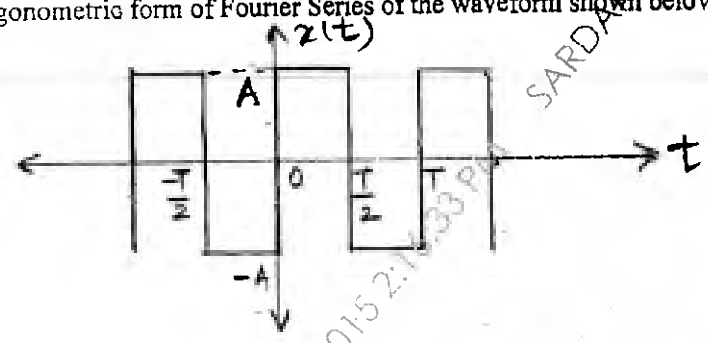
N.B.:

1. Question no.1 is compulsory
2. Attempt any three questions out of the remaining five.
3. Assume suitable data wherever necessary.

1. \_\_\_\_\_ (20)

- a) Determine the fundamental period of the following signals.
  - i)  $x(t) = 2\cos\frac{2\pi t}{3} + 3\cos\frac{2\pi t}{7}$
  - ii)  $x[n] = \cos^2\left[\frac{\pi}{4}n\right]$
- b) Prove and explain time scaling and amplitude scaling property of Continuous time Fourier Transform.
- c) For the given system, determine whether it is, i) memory less, ii) causal, iii) time-invariant  
 $y[n] = nx[n]$
- d) Find out even and odd component of the following signal.  
 $x(t) = \cos^2\left(\frac{\pi t}{2}\right)$

2. a) Determine the trigonometric form of Fourier Series of the waveform shown below. (10)



- b) State duality property of Fourier Transform. If Fourier Transform of  $e^{-t}u(t)$  is  $\frac{1}{1+j\Omega}$ , then find the Fourier Transform of  $\frac{1}{1+t}$  using duality property. (10)

3. a) Obtain inverse Laplace transform of the function. Write down and sketch possible ROCs. (10)

$$X(s) = \frac{8}{(s+2)^3(s+4)}$$

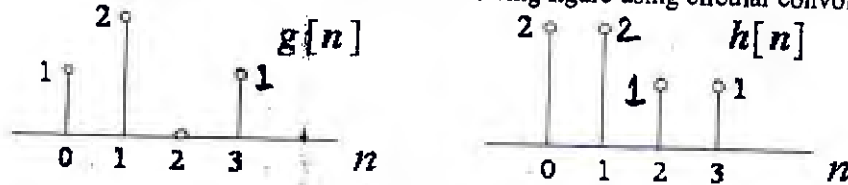
- b) Using the z transform, solve the difference equation and find out impulse response. (10)

$$y[n] - 2y[n-1] + y[n-2] = x[n] + 3x[n-3]$$

4.

- a) State and explain different properties of ROC of Z transform. (5)

- b) Convolve the sequences shown in the following figure using circular convolution (5)



- c) A continuous time signal is shown below. Sketch the following transformed versions of the signal. (10)



- i)  $x(t-3)$     ii)  $-2x(t)$     iii)  $x(t-3)-2x(t)$     iv)  $\frac{dx(t)}{dt}$

5.

- a) Convolve  $x[n] = \left(\frac{1}{3}\right)^n u[n]$  with  $h[n] = \left(\frac{1}{2}\right)^n u[n]$  using convolution integral. (10)

- b) A second order LTI system is described by  $\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = x(t)$ . Determine the transfer function and the poles and zeros of the systems. Evaluate zero-state response to  $x(t)=u(t)$  (10)

6.

- a) For the periodic signal  $x[n]$  given below find out Fourier series coefficient. (10)

$$x[n] = 1 + \sin\left(\frac{2\pi}{N}n\right) + 3 \cos\left(\frac{2\pi}{N}n\right) + \cos\left(\frac{4\pi}{N}n + \frac{\pi}{2}\right)$$

- b) The input and impulse responses of continuous time system are given below. Find out output of the continuous time systems using appropriate method. (10)

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