

P. Pages : 3

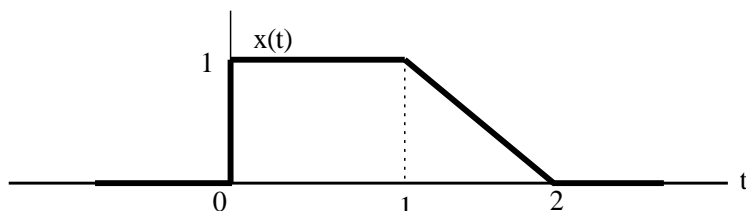
Time : Three Hours

**GUG/W/24/13860**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Assume suitable data wherever necessary.
 3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Given the signal $x(t)$, draw the following signals.

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- i) $x(t+1)$
- ii) $x(-t+1)$
- iii) $x\left(\frac{3}{2}t\right)$
- iv) $x\left(-\frac{3}{2}t+1\right)$

- b) Define Energy Signal and Power Signal both in discrete time as well as continuous time. Check whether the following signals are energy signal, power signal or neither energy nor power signal.

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- i) $x(t) = e^{-at}u(t)$
- ii) $x(n) = u(n)$

OR

2. a) Define the following systems:

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- i) Invertible and non-invertible.
- ii) Causal and non-causal system.
- iii) Time variant and time invariant system.
- iv) Linear and Non-linear system.

- b) Determine whether the following signals are periodic or aperiodic, if periodic, determine its fundamental period.

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- i) $x(t) = \sin^2(4\pi t)$
- ii) $x(t) = \sin 6\pi t + \cos 5\pi t$

3. a) Explain the concept of stability and causality in LTI systems. Check whether the following systems whose impulse response is given below are stable and causal

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- i) $h(t) = te^{-t}u(t)$
- ii) $h(n) = 2^n u(-n)$

- b) Using graphical method find the output of the LTI system whose impulse response $h(n) = \{1, 1, 1\}$ and input $x(n) = \{0, 5, 2\}$. 8

OR

4. a) Explain the properties of LTI system. Find the overall impulse response of the LTI system if (i) two LTI systems are connected in parallel. (ii) two LTI systems are connected in cascade. 8

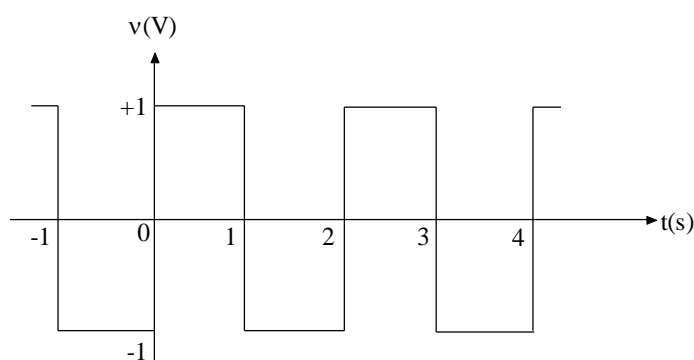
- b) Given: 8

$$x(t) = e^{-at}u(t), a > 0$$

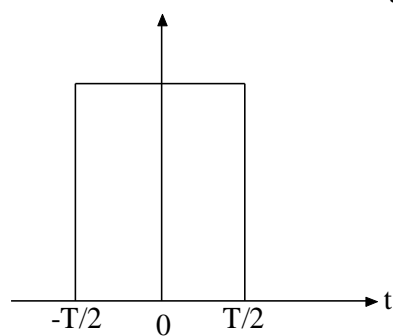
$$h(t) = u(t)$$

Find $y(t)$ which denotes the convolution of $x(t)$ and $h(t)$.

5. a) Find the Fourier series representation of the following signal. 8



- b) Find the Fourier transform of the signal shown in figure. 8



Figure

OR

6. a) Prove time shifting property of Fourier transform. Using the property find Fourier transform of $e^{-t}u(t-2)$. 8

- b) Determine the Fourier Series of each of the following periodic signal: 8

i) $\sin\left(2\pi t + \frac{\pi}{4}\right)$

ii) $1 + \cos\left(6\pi t + \frac{\pi}{8}\right)$

7. a) Find the inverse Laplace transform of the function given by $X(s) = \frac{2s+5}{(s+2)(s+3)}$ for the following cases. 8
- i) RoC : $\text{Re}\{s\} > -2$
 - ii) RoC : $\text{Re}\{s\} < -3$
 - iii) RoC : $-3 < \text{Re}\{s\} < -2$

- b) What is ROC of Laplace transform (explain using mathematical expressions)? Also state its properties. 8

OR

8. a) If $Y(z) = \frac{1-3z^{-1}}{(1^{-1}/2z^{-1})(1-2z^{-1})}$ Find the inverse Z-Transform if 8
- i) System is stable
 - ii) System is causal
 - iii) System is anti-causal.

- b) Obtain the z-transform of the following. 8
- i) $x(n) = \sin(\omega_0 n) u(n)$
 - ii) $x(n) = \cos(\omega_0 n) u(n)$

9. a) An analog signal is given as $x_a(t) = \sin(100\pi t) + 2\sin(200\pi t) + 3\cos(300\pi t)$ 8
- i) What is the Nyquist rate of this signal.
 - ii) If the signal is sampled with $F_s = 200$ Hz, what is the discrete time signal obtained after sampling?

- b) Write short note on: 8
- i) Flat-Top sampling
 - ii) Zero order hold circuit

OR

10. a) State and prove the sampling theorem. 8
- b) Explain the reconstruction of signal from its samples using interpolation. 8
