Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80440

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third Semester

Electronics and Communication Engineering

EC 2204/EC 35/EC 1202 A/080290015/10144 EC 305 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering)

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define discrete time unit step and unit impulse functions.

2. Define energy and power signals.

3. Give synthesis and analysis equations of continuous time Fourier transform.

4. Define the region of convergence of the Laplace transform.

5. Determine the Laplace transform of the signal $\delta(t-5)$ and $u(t-5)$.

6. Determine the convolution of the signals $x[n]=\{2,-1,3,2\}$ and $h[n]=\{1,-1,1,1\}$.

7. What is the z-transform of $\delta(n+k)$?

8. What is aliasing?

9. Define convolution sum with its equation.

10. Check whether the system with system function $H(z)=\dfrac{1}{1-\frac{1}{2}z^{-1}}+\dfrac{1}{1-2z^{-1}}$ with ROC $|Z|<\dfrac{1}{2}$ is causal and stable.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the even and odd components of the signal $x(n) = \{1, 0, -1, 2, 3\}$. (8)

(ii) Find the fundamental period of the signal $x(t) = e^{j\frac{7\pi}{3}n}$. (8)

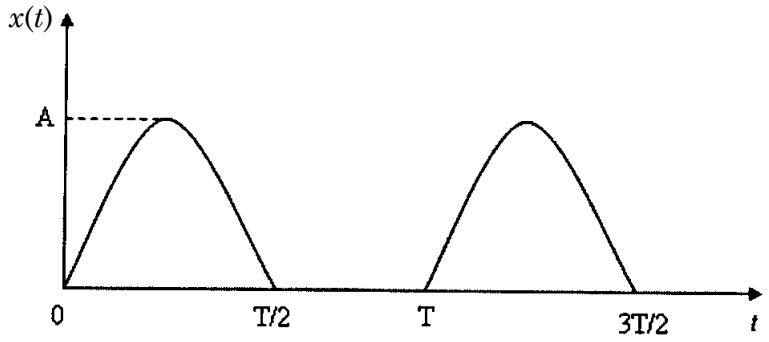
Or

(b) (i) Check the system $y(n) = \log_{10}|x(n)|$ is linear, time invariant, causal and static. (10)

(ii) Find the summation $\sum_{n=0}^{5} \delta(n+1)2^n$. (6)

12. (a) (i) State Dirichlet's conditions. Also state its importance. (4)

(ii) Obtain the trigonometric Fourier series for the half wave rectified sine wave given below. (12)



Or

(b) (i) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-2|t|}$. Also draw its amplitude and phase spectra. (8)

(ii) Obtain the inverse Laplace transform of the function $X(s) = \frac{1}{s^2 + 3s + 2}$, ROC : $-2 < \text{Re}\{s\} < -1$. (8)

13. (a) Compute and plot the convolution $y(t)$ of the given signals (8 + 8)

(i) $x(t) = u(t-3) - u(t-5),\ h(t) = e^{-3t}u(t)$

(ii) $x(t) = u(t),\qquad h(t) = e^{-t}u(t)$.

Or

(b) The LTI system is characterized by impulse response function given by $H(s) = 1/(s+10)$ ROC : $\mathrm{Re} > -10$.

Determine the output of a system when it is excited by the input

$x(t) = -2e^{-2t}u(-t) - 3e^{-t}u(t)$.

14. (a) (i) Determine the Z transform of $x(n) = a^n \cos(\omega_o n)u(n)$. (8)

(ii) Determine the inverse Z transform of $X(z) = \dfrac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$ for $ROC|Z| > 1$. (8)

Or

(b) (i) State and prove the time shift and frequency shift property of DTFT. (8)

(ii) Determine the DTFT of $\left(\frac{1}{2}\right)^n u(n)$. Plot its spectrum. (8)

15. (a) (i) Compute convolution sum of the following sequences

$$x(n) = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & Otherwise \end{cases} \text{ and}$$

$$h(n) = \begin{cases} \alpha^n, & 0 \le n \le 6 \\ 0, & Otherwise \end{cases}.$$ (10)

(ii) Draw direct form I and direct form II implementations of the system described by difference equation.

$$y(n) + \frac{1}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + x(n-1).$$ (6)

Or

(b) (i) Determine the transfer function and the impulse response for the causal LTI system described by the difference equation using z transform.

$$y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1).$$ (8)

(ii) Develop the state variable description for the discrete time system given below. (8)