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

Question Paper Code: 94B04

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Fourth Semester

Biomedical Engineering

19UBM404-PRINCIPLES OF SIGNALS AND SYSTEMS

(Regulation 2019)

Duration: 1:45hrsMaximum: 50 Marks

PART A - (10 x 2 = 20 Marks)

Answer any ten of the following questions

1. Give the graphical and mathematical representation of Unit step sequence and Unit ramp sequence. (CO1: Understand)
2. Differentiate continuous time signal and discrete time signals. (CO1: Understand)
3. Determine odd and even components of the signal $x(t)=e^{jt}$. (CO1: Apply)
4. Find the Laplace transform of $\cos\omega_o t\, u(t)$ using property. (CO2: Apply)
5. State Dirichlets conditions. (CO2: Understand)
6. Determine the Fourier transform of sgn function. (CO2: Apply)
7. Check whether the causal system with transfer function H(s)=1/(s-2) is stable. (CO4: Apply)
8. Write Nth order differential equation and its Laplace transform. (CO3: Understand)
9. Determine the response of the system with impulse response h(t)=tu(t) for the input signal x(t) =u(t). (CO3: Apply)
10. State the condition for existence of DTFT? (CO2: Understand)
11. Obtain inverse z-transform of X(z)=1/(z-a), |z|>|a|. (CO4: Apply)
12. Determine z-transform of the sequence x[n]={1,2,3,4}. (CO2: Apply)
13. Give the relationship between impulse response and transfer function of DT-LTI system. (CO4: Understand)
14. Determine the convolution of the two sequence x[n]={1,1,1,} and h[n]={2,2}. (CO4: Apply)
15. Obtain convolution of x[n] and δ[n]. (CO4: Apply)

PART -- B (5 x 16= 80 Marks)

16. (a) For each of the following input-output relationship, check whether the corresponding system is linear, time invariant and causal. (CO1: Apply)

(a) $y(t)=t^2x(t-1)$ [5]

(b) $y[n]=x^2[n-2]$ [5]

Or

(b) Determine whether the system $y[n] = 2x(n-2)$ is memory less, causal, linear, time invariant, invertible and stable. Justify your answers.

17. (a) Prove convolution and multiplication properties of Laplace transform. (CO2: Understand)

Or

(b) Obtain the Fourier co-efficient and write the quadrature form of a fully rectified sine wave. (CO2: Ana)

18. (a) A pressure gauge that can be modeled as an LTI system has a time response to a unit step input given by $(1-e^{-t}-te^{-t})u(t)$. For a certain input x(t), the output is observed to be $(2-3e^{-t}+e^{-3t})u(t)$. For this observed measurement, determine the true pressure input to gauge as a function of time. (CO4: Analyze)

Or

(b) An LTI system is represented by $\frac{d^2}{dt^2}y(t) + 4\frac{d}{dt}y(t) + 4y(t) = x(t)$ with initial condition $y(\bar{0}) = 0; y'(\bar{0}) = 1$; Find the output of the system, when the input is $x|t| = e^{-1}u(t)$. (CO3:App)

19. (a) Consider a discrete time LTI system with impulse response

$$h[n]=\left(\frac{1}{2}\right)^n u[n]$$

Use Fourier transforms to determine the response to each of the following input signal

i) $x[n]=\left(\frac{3}{4}\right)^n u[n]$

(CO4: Analyze)

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

Or

(b) Find inverse z-transform of X(z) = $\frac{z^{-1}}{1 - 0.25\ z^{-1} - 0.375\ z^{-2}}$ (CO4:App)

For ROC |z| > 0.75; ROC |z| < 0.5

20. (a) Consider an LTI system with impulse response

$$h[n] = \begin{cases} a^n & n \geq 0 \\ 0 & n < 0 \end{cases}$$

and input

$$x[n] = \begin{cases} 1 & 0 \leq n \leq N-1 \\ 0 & otherwise \end{cases}$$

Determine the output y[n] by explicitly evaluating the discrete convolution of x[n] and h[n]. (CO5: Apply)

Or

(b) For a causal LTI system the input x(n) and output y(n) are related through a difference equation $y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n)$. Determine the frequency response $H(e^{jw})$ and the impulse response $h(n)$ of the system. (CO5: Apply)