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**Question Paper Code: U3B03**

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Third Semester

Biomedical Engineering

21UBM303- PRINCIPLES OF SIGNALS AND SYSTEMS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

1. Sketch the given signal. CO2- Ana  
 $u[n+2] - u[n-3]$
2. Is the signal  $x(t)=10\cos(2\pi t) + \sin(5\pi t)$  a periodic signal. If it is, determine the fundamental period? CO2- Ana
3. State Convolution property for laplace transforms. CO1- U
4. Define fourier transform pair. CO1- U
5. Define LTI-CT systems. CO1- U
6. What are the tools used for analysis of LTI-CT systems? CO1- U
7. Define Sampling theorem. CO1- U
8. Write the main condition to avoid aliasing? CO1- U
9. Illustrate the relationship between impulse response and transfer function of a DT-LTI system. CO3- App
10. Is the discrete time system described by the difference equation  $y(n) = x(-n)$  causal? CO3- App

PART – B (5 x 16= 80Marks)

11. (a) Classify the different types of systems and explain them. CO3-App (16)

Or

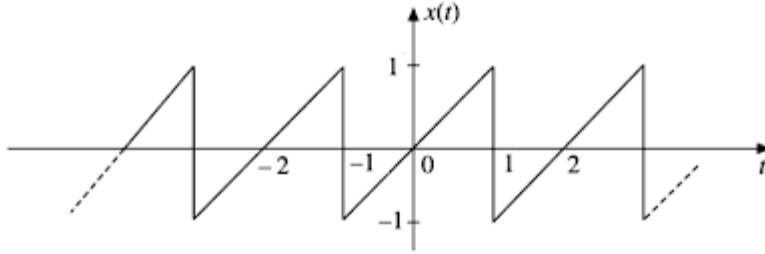
- (b) For each of the following input-output relationship, check whether CO3-App (16)

the corresponding system is linear, time invariant and causal.

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

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

12. (a) Determine the trigonometric Fourier series for the periodic signal  $x(t)$  shown in the figure. CO3-App (16)



Or

- (b) Calculate the Laplace Transform of the following signals and sketch the ROC CO3-App (16)
- (i)  $x(t) = e^{-2t} u(t)$ .
- (ii)  $x(t) = e^{-at}u(t)+e^{-bt} u(-t)$
13. (a) An LTI system is represented by  $d^2y(t)/dt^2 + 5 dy(t)/dt + 6y(t) = dx(t)/dt + x(t)$  with initial conditions  $y(0)=1, y'(0)=3$ . Conclude the output of the system, when the input is  $x(t)= u(t)$ . CO3-App (16)

Or

- (b) Examine the convolution  $y(t)$  of the given signals. CO3-App (16)
- (i)  $x(t)=\cos t u(t), h(t)=u(t)$
- (ii)  $x(t)=u(t), h(t)= u(t)$
- (iii)  $x(t) = u(t+1); h(t) = u(t-2)$
- (iv)  $x(t) = e^{-at}u(t) h(t) = e^{-bt}u(t)$

14. (a) Consider the analog signal  $x(t)= 5\sin 4000\pi t+12\cos 2000\pi t$ . CO3-App (16)
- (i) Discuss the Nyquist sampling rate.
- (ii) If the analog signal is sampled at  $F_s = 5000$  Hz, Formulate the discrete time signal obtained by sampling.

Or

- (b) Find the impulse response of the discrete time system described by the difference equation CO3-App (16)
- $$y(n - 2) - 3 y(n - 1) + 2 y(n) = x(n - 1)$$

15. (a) Determine the system function and output response  $y(n)$  of a linear time invariant discrete time system specified by the equation  $y(n) - 1.5y(n-1) + 0.5y(n-2) = 2x(n) + 1.5x(n-1)$  CO3-App (16)
- Or
- (b) Obtain the direct form I and Direct form II realization of the system described by the difference equation  $y(n) + 0.75y(n-1) - 0.125y(n-2) = x(n) + 7x(n-1) + x(n-2)$ . CO3-App (16)

