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

Question Paper Code: R3B03

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

Third Semester

Biomedical Engineering

R21UBM303- PRINCIPLES OF SIGNALS AND SYSTEMS

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

1.	Differentiate between causal and non-causal systems.	CO1-U
2.	Is the signal x(t)=10cos(2πt) + sin(5πt) a periodic signal. If it is, determine the fundamental period.	CO2-App
3.	Write the dirichlets conditions for Fourier series.	CO1-U
4.	Define Fourier transform pair.	CO1-U
5.	What are the tools used for analysis of LTI-CT systems?	CO1-U
6.	Illustrate the three elementary operations in block diagram representation of continuous time system.	CO1-U
7.	Define Sampling theorem.	CO1-U
8.	State the convolution property of the Z-transform.	CO1-U
9.	Distinguish between non-recursive and recursive systems.	CO1-U
10.	Determine the convolution of the signals x(n) = {2, – 1, 3, 2} and h(n) = {1, – 1, 1, 1}.	CO2-App

PART – B (5 x 16= 80Marks)

11.	(a)	(i) Sketch the given signals and find whether it is an energy or power signal $x(t) = u(t) - u(t-15)$.	CO2-App	(8)
		(ii) Find the odd and even components of the signal $x(n) = \{1, 0, -1, 2, 3\}$ ↑	CO2-App	(8)

Or

(b) Check whether the corresponding system is static, linear, time invariant and causal. CO2-App (16)

(i) $y(n) = \frac{1}{(x(n-1))} + x(n) + x(n+1)$

(ii) $y(n) = x(n).x(n-1)$

12. (a) (i) Examine the Laplace transform of the given signal and sketch the associated ROC: $x(t) = e^{-3t}u(t) + e^{-2t}u(t)$ CO3-App (8)

(ii) State and prove the Parseval's relation for continuous time signals using Fourier transform CO1-U (8)

Or

(b) (i) Determine the unilateral Laplace transform of the given signals. CO3-App (8)

A) $x(t) = cos(\omega_o t)$.

B) $x(t) = u(t)$

(ii) State and prove time shifting and linearity properties of the Laplace transform. CO1-U (8)

13. (a) A system is described by the differential equation CO3-App (16)

$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + 4x(t)$and the input is$x(t) = e^{-t}u(t)$. Find

i) The natural response for initial conditions y(0) = 3;$\frac{dy(t)}{dt} = 0$

ii) Forced response.

iii) Total response.

Or

(b) Evaluate the response y(t) of a continuous time system using Laplacetransform with transfer function H(s) =$\frac{1}{(s+2)(S+3)}$ for an input $x(t) = e^{-t}u(t)$. CO3-App (16)

14. (a) (i) Determine the DTFT of the given signals. CO3-App (10)

A) $x(n) = u(n-k)$

B) $x(n) = \{1, -2,\ 2,\ 2\}$

(ii) Experiment the Z-transform of the sequence CO3-App (6)

$$x(n) = \{5, \quad 3, \quad 2, \quad 4, \quad 3, \quad 1\}$$

Or

(b) (i) Consider an analog signal $x(t) = 5cos200\pi t$.Examine the minimum sampling rate to avoid aliasing effect.If sampling rate Fs =400Hz,determine the discrete time signal after sampling? CO3-App (10)

(ii) Solve the Z transform and find ROC of CO3-App (6)

$x(n) = u(n) - u(n-3)$.

15. (a) (i) Formulate the linear convolution of $x(n) = \{1,\ 4,\ 3,\ 2\}$ and $h(n) = \{1,\ 3,\ 2,\ 1\}$ CO3-App (8)

(ii) In LTI discrete time system$y(n) = \frac{3}{2}y(n-1) - \frac{1}{2}y(n-2) + x(n) + x(n-1)$ is given an input$x(n) = u(n)$. Evaluate the transfer function of the system. CO3-App (8)

Or

(b) Obtain the direct form I and Direct form II realization of the system described by the difference equation CO3-App (16)

$y(n) + 0.75y(n-1) - 0.125y(n-2) = x(n) + 7x(n-1) + x(n-2)$.