A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54B04

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Biomedical Engineering

15UBM404 - PRINCIPLES OF SIGNALS AND SYSTEMS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. _____ signal's amplitude increased linearly with positive value of independent variable. CO1- R

   (a) Impulse (b) Step (c) Ramp (d) Sinusoidal

2. A system whose output depends only on the present and past inputs is called as _____ system. CO1- R

   (a) Causal (b Stable (c) Linear (d) Non-recursive

3. A complicated waveform analyzed into a number of harmonically related sine and cosine functions is _____. CO2- R

   (a) Fourier Series (b) Laplace (c) Z-Transform (d) Differential Equation

4. Laplace transform of unit step input is _____. CO2- R

   (a) 1 (b) K (c) S (d) 1/S

5. Two systems with impulse response $h_1(t)$ and $h_2(t)$ are in parallel then overall impulse response h(t) is _____. CO3- R

   (a) $h_1(t) + h_2(t)$ (b) $h_1(t) - h_2(t)$ (c) $h_1(t) * h_2(t)$ (d) $h_1(t) / h_2(t)$

6. The commutative property of convolution is CO3- R

   (a) x(t)*h1(t)+x(t)*h2(t) = x(t)*[h1(t)+h2(t)] (b) [x(t)*h1(t)]*h2(t) = x(t)*[h1(t)*h2(t)]

   (c) [x(t)+h1(t)]*[x(t)+h2(t)] = x(t)*[h1(t)+h2(t)] (d) x(t)*h(t) = h(t)*x(t)

7. In order to avoid aliasing the sampling frequency (Fs) should be _____ the maximum frequency (Fm) of continuous time signal. CO4- R

(a) Less than or equal to (b) Greater than or equal to

(c) Less than or equal to twice (d) Greater than or equal to twice

8. Time interval between any two adjacent samples in sampling technique is __. CO4- R

(a) Sampling Rate (b) Nyquist Rate (c) Nyquist Interval (d) Aliasing

9. Z transform of unit impulse signal is _____. CO5- R

(a) 1 (b) z (c) Z^{-1} (d) Infinity

10. Z Transform for the difference equation y(n)=0.5y(n-1) + x(n) CO5- R

(a) $Y(Z)(1+0.5Z^{-1}) = X(Z)$ (b) $Y(Z)(1-0.5Z^{-1}) = X(Z)$

(c) $Y(Z)(1+0.5Z) = X(Z)$ (d) $Y(Z)(1-0.5Z) = X(Z)$

PART – B (5 x 2= 10 Marks)

11. Sketch the signal, $x(n)= \delta(n-1) + \delta(n+1)$ CO1- R

12. Write the conditions for existence of Fourier Series. CO2- R

13. The impulse response of the LTI-CT system is given by $h(t) = e^{-t}\, u(t)$. Determine transfer function and check whether the system is causal and stable. CO3- R

14. Find DTFT of $(1/8)^n u(n)$. CO4- R

15. State the significance of block diagram representation. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) (i) Write a brief note classification of CT signals. CO1- App (8)

(ii) Check whether the following signals are energy or power signals. If so compute their average power or total energy. CO1- App (8)

a) $x(n) = \left(\frac{1}{7}\right)^n u(n)$

b) $x(t) = cos^2(\omega_0 t)$

Or

(b) (i) Write a brief note classification of CT and DT systems. CO1- App (8)

(ii) Classify the following systems for Causality, Time invariance, Stability and Memory — CO1- App (8)

a) $\frac{dy(t)}{dt} + ty(t) = x(t)$

b) $y(n) = x(n^2)$

17. (a) State and prove the following properties of Fourier Transform. — CO2- App (16)

(i) Time scaling property

(ii) Time shifting property

(iii) Time reversal

(iv) frequency shifting property

Or

(b) (i) Find the laplace transform and ROC for the following CT signal. — CO2- App (8)

$x(t) = e^{-at}u(t) + e^{-bt}u(-t)$

(ii) Find the inverse laplace transform of $X(S) = \frac{S-2}{S(S+1)^3}$ — CO2- App (8)

18. (a) (i) Realize the system described by following differential equation in direct form I and direct form II realization — CO3- App (8)

$$\frac{d^3y(t)}{dt^3} + 4\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 12y(t) = \frac{d^3x(t)}{dt^3} + 2\frac{d^2x(t)}{dt^2} + 3\frac{dx(t)}{dt} + x(t).$$

(ii) Realize the transfer function — CO3- App (8)

$$H(S) = \frac{S(S+2)}{(S+1)(S+3)(S+4)}$$

in cascaded and parallel form structures.

Or

(b) Find the inverse Laplace transform of CO3- App (16)

$X(S) = \frac{4}{S^2+6S+8}$. For following ROC's

(i) -2> Re(S) > -4
(ii) Re(S) < -4
(iii) Re(S) > -2.

19. (a) (i) State and prove the following properties of Discrete Time Fourier Series. CO4- App (8)
    (a) Linearity
    (b) Time Shifting

    (ii) Compute the DTFT of following signals. CO4- App (8)

    (a) $x(n) = \left(\frac{1}{2}\right)^n u(n)$

    (b) $x(n) = -\left(\frac{1}{4}\right)^n u(-n-1)$

Or

(b) (i) State and prove any two properties of Z-transform. CO4- App (8)

(ii) Compute the Z-transform of following signals. CO4- App (8)

(a) $x(n) = \left(\frac{1}{3}\right)^n u(n)$

(b) $x(n) = -\left(\frac{1}{6}\right)^n u(-n-1)$

20. (a) Find the convolution of following sequences $x_1(n)$ = (1, 2, 1, -1) and the input signal $x_2(n)$ = {1, 2, 3, 1} using tabular method, matrix method and graphical methods. CO5- App (16)

Or

(b) Find the impulse response of the discrete time system described by the difference equation CO5- App (16)

y(n) - 3y(n-1) - 4y(n-2) = x(n) +2x(n-1) using Z transform.