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

Question Paper Code: 54B04

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

Fourth Semester

Biomedical Engineering

15UBM404 - PRINCIPLES OF SIGNALS AND SYSTEMS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. Periodic signals are CO1-R

   (a) $x(t+T)=X(t)$ (b) $x(t-T)=x(t)$ (c) $x(n+mN)=x[n]$ (d) All the above

2. Power signals are this signals with CO1-R

   (a) $0<E<\infty, P=0$ (b) $0<E<\infty, P=\infty$ (c) $0<P<\infty, E=\infty$ (d) $0<P<\infty, E=0$

3. Laplace transform of $x(t)=t$ is CO2-R

   (a) $\frac{2}{s^2}$ (b) $\frac{1}{s^2}$ (c) s^2 (d) $\frac{1}{s}$

4. Phase spectrum $\Phi(\omega)$ is an CO2-R

   (a) Even function (b) Odd Function

   (c) Both (a) and (b) (d) Neither even nor odd function

5. Impulse response is the output of _____ system due to impulse input applied at time=0? CO3-R

   (a) Linear (b) Time varying

   (c) Time invariant (d) Linear and time invariant

6. Find the convolution sum of sequences x1[n] = (1, 2, 3) and x2[n] = (2, 1, 4). CO3-R

   (a) {2, 5, 12, 11, 12} (b) {2, 12, 5, 11, 12} (c) {2, 11, 5, 12, 12} (d) {-2, 5,-12, 11, 12}

7. Aliasing occurs when sampling frequency w_s CO4-R

   (a) $w_s=0$ (b) $w_s \geq 2w_m$ (c) $w_s \geq w_m$ (d) $w_s < 2w_m$

8. z- transforms of $x[-n]$ is CO4-R

(a) $-x(z)$ (b) $x(-z)$ (c) $x\left[\frac{1}{z}\right]$ (d) $\frac{1}{x(z)}$

9. If $x[n]$ is real and odd, then its discrete Fourier series coefficient c_k will be CO5-R

(a) real (b) odd (c) imaginary (d) both (a) and (c)

10. Z – transforms of $nx[n]$ is CO5-R

(a) $\frac{dX(z)}{dz}$ (b) $z\frac{dX(z)}{dz}$ (c) $\frac{d^2X(z)}{dz^2}$ (d) $-z\frac{dX(z)}{dz}$

PART – B (5 x 2= 10Marks)

11. What is a random signal? Give an example. CO1-R

12. What is the condition for the existence of Fourier series for a signal? CO2-R

13. Will there be two different signals having same Laplace transform? Give an example. How do you differentiate these two signals? CO3-R

14. State and prove the time folding property of Z – transform. CO4-R

15. Write the condition for stability of a DT – LTI system with respect to the position of poles. CO5-R

PART – C (5 x 16= 80Marks)

16. (a) (i) How the unit impulse function $\delta(t)$, unit step function u (t) and ramp function r (t) can be related? Also give the Mathematical representation and graphical representation of the above three functions. CO1-App (8)

(ii) Determine whether the following signals is periodic. If a signal is periodic, determine its fundamental period. CO1-App (8)

(a) $x(t) = \cos\frac{\pi}{3}t + \sin\frac{\pi}{4}t$

(b) $x[n] = \cos\frac{n}{4}$

Or

(b) Determine whether the system $y[n] = 2x(n-2)$ is memory less, causal, linear, time invariant, invertible and stable. Justify your answers. CO1-App (16)

17. (a) Obtain the Fourier co-efficient and write the quadrature form of a fully rectified sine wave. CO2-Ana (16)

Or

(b) Determine the inverse Laplace Transform of the following CO2-App (16)

(i) $x(s) = \dfrac{1-2s^2-14s}{s(s+3)(s+4)}$

(ii) $x(s) = \dfrac{2s^2+10s+7}{(s+1)(s^2+3s+2)}$

18. (a) (i) Using Laplace transform of x(t). Give the pole – zero plot and find ROC of the signal x(t) . $x(t) = e^{-b|t|}$ For both b>0 and b<0. CO3-App (10)

(ii) Find the condition for which Fourier transform exists for x(t). Find the Laplace transform of x(t) and its ROC. X(t) = $e^{-at}u(-t)$. CO3-App (6)

Or

(b) An LTI system is represented by $\dfrac{d^2}{dt^2}y(t) + 4\dfrac{d}{dt}y(t) + 4y(t) = x(t)$ 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 (16)

19. (a) State and prove sampling theorem for a band limited signal. CO4-U (16)

Or

(b) Find inverse z-transform of X(z) = $\dfrac{z^{-1}}{1-0.25z^{-1}-0.375z^{-2}}$ CO4-App (16)

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

20. (a) Convolve the following sequences CO5-App (16)

$x[n] = a^n u[n], a < 1$

$h[n] = u[n]$

Or

(b) For a causal LTI system the input x(n) and output y(n) are related through a difference equation $y(n) - \dfrac{1}{6}y(n-1) - \dfrac{1}{6}y(n-2) = x(n)$. Determine the frequency response $H(e^{jw})$ and the impulse response $h(n)$ of the system. CO5-App (16)