Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
Third Semester

18ECC104T – SIGNALS AND SYSTEMS
(For the candidates admitted during the academic year 2018-2019 onwards)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours | Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. Which of the following is a periodic signal?
   (A) $x(t)=Au(t)$ (B) $x(t)=Ae^{-jbt}$
   (C) $x(t)=Ae^{bt}$ (D) $x(t)=At$

2. The differentiation of a unit step signal is
   (A) Ramp signal (B) Impulse signal
   (C) Exponential signal (D) Parabolic signal

3. Identify the energy signal from the following signals
   (A) $x(t)=Ae^{j\Omega_0 t}$ (B) $x(t)=A\sin\Omega_0 t$
   (C) $x(t)=B\cos\Omega_0 t$ (D) $x(t)=e^{-at}u(t)$

4. Which of the following is a non-causal system?
   (A) $y(t)=\dfrac{dx(t)}{dt}$ (B) $y(t)=\int_0^t x(\tau)d\tau$
   (C) $y(t)=e^{x(t)}$ (D) $y(t)=x(t^2)$

5. For waveforms with odd symmetry, the Fourier coefficients a_0 and a_n are always
   (A) Zero (B) One
   (C) Two (D) Infinity

6. If a signal $x(t)$ has odd and half wave symmetry, then the Fourier series will have
   (A) Odd harmonics of sine terms (B) Even harmonics of sine terms
   (C) Constant term and odd harmonics of cosine terms (D) Odd harmonics of cosine terms

7. The Fourier transform for $x(t)$ exists only if
   (A) $\int_0^\infty x(t)dt<\infty$ (B) $\int_{-\infty}^\infty x(t)dt>0$
   (C) $\int_{-\infty}^\infty x(t)e^{j\Omega t}dt<\infty$ (D) $\int_{-\infty}^\infty x(t)dt<\infty$

8. The Fourier transform of the signal $x(t)=e^{7t}u(-t)$ is

(A) $\frac{1}{7+j\Omega}$ (B) $\frac{7}{1+j\Omega}$

(C) $\frac{7}{1-j\Omega}$ (D) $\frac{1}{7-j\Omega}$

9. The convolution of $u(t)$ with $u(t)$ is equal to

(A) $s(t)$ (B) $u(t)$

(C) $tu(t)$ (D) $t^2u(t)$

10. If $x(t), y(t)$ and $h(t)$ are input, output and impulse response of LTI continuous time system respectively then

(A) $h(t)=x(t)*y(t)$ (B) $x(t)=y(t)*h(t)$

(C) $y(t)=x(t)*h(t)$ (D) $y(t)=h(t)*h(t)$

11. The Laplace transform of the causal signal $t^n u(t)$ is

(A) $\frac{n!}{s^n+1}$ (B) $\frac{n!}{s^n}$

(C) $\frac{n}{s^n+1}$ (D) $\frac{n}{s^n}$

12. The inverse Laplace transform of $X(s)=\frac{2}{s^2+2s+5}$ is

(A) $x(t)=e^{-t}\cos 2t$ (B) $x(t)=e^{-t}\sin 2t$

(C) $x(t)=e^{-t}\cos 5t$ (D) $x(t)=e^{-2t}\sin 5t$

13. If $x(n)=a^n u(n)$ is the input signal, then the particular solution $y_p(n)$ will be

(A) $K^n a^n u(n)$ (B) $Ka^n u(n)$

(C) $K_1 a^n u(n)+K_2 a^n u(n)$ (D) $Ka^{-n}u(n)$

14. The zero input or natural response is mainly due to

(A) Initial stored energy in the system (B) Present conditions in the system

(C) Specific input signal (D) Specific output signal

15. In N-point DFT of L-point sequence, the value of N to avoid aliasing in frequency spectrum is

(A) $N \neq L$ (B) $N \leq L$

(C) $N \geq L$ (D) $N = L$

16. The inverse DFT of $x(n)$ can be expressed as

(A) $x(n)=\frac{1}{N}\sum_{K=0}^{N} X(k)e^{\frac{-j2\pi kn}{N}}$ (B) $\frac{1}{N}\sum_{K=0}^{N-1} X(k)e^{\frac{j2\pi kn}{N}}$

(C) $\frac{1}{N}\sum_{n=0}^{N-1} X(n)e^{\frac{-j2\pi kn}{N}}$ (D) $N\sum_{n=0}^{N-1} X(k)e^{\frac{-j2\pi kn}{N}}$

17. The ROC of the sequence $x(n)=u(-n)$ is

(A) $|Z|>1$
(B) $|Z|<1$
(C) No ROC
(D) $-1<|Z|<1$

18. Inverse Z-transform of $\dfrac{3}{Z-4}$ $|Z|>4$ is

(A) $3(4)^{n}u(n-1)$
(B) $3(4)^{n-1}u(n)$
(C) $3(4)^{n-1}u(n+1)$
(D) $3(4)^{n-1}u(n-1)$

19. The structure that uses separate delays for the input and output samples is

(A) Direct form II
(B) Direct form I
(C) Cascade form
(D) Parallel form

20. Number of multipliers and adders required for direct form realization of N[th] order FIR system are

(A) $N,\ N+1$
(B) $N,\ N-1$
(C) N+1, N
(D) N–1, N+1

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Sketch the given signal and calculate its energy
$x(t)=e^{-10t}u(t)$

22. Find the inverse Fourier transform of the following signals
(i) $\delta(\Omega)$
(ii) $\delta(\Omega-\Omega_0)$

23. Find the Laplace transform of the signal and find ROC
$x(t)=e^{-3t}u(t)+e^{-2t}u(t)$

24. Find the convolution of the following signals.
$x(n)=\cos\pi n u(n);\ h(n)=\left(\frac{1}{2}\right)^{n}u(n)$

25. Determine the Z transform of the signal $x(n)=-b^{n}u(-n-1)$. Find the region of convergence.

26. Find the odd and even components of the signal
$x(n)=\left\{-2,1,\underset{\uparrow}{2},-1,3\right\}$

27. What are the properties of region of convergence?

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

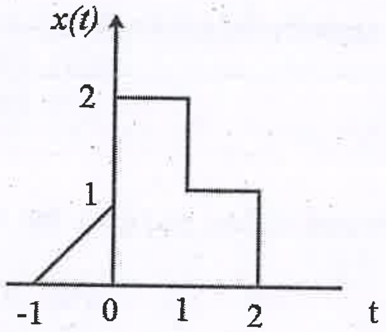
28. a. For the signal $x(t)$ shown below, find the following

(i) $x(t-2)$

(ii) $x(2t+3)$

(iii) $x\left(\frac{3}{2}t\right)$

(iv) $x(-t+1)$



(OR)

b. Check whether the following systems are

(i) Static/Dynamic

(ii) Linear/Non Linear

(iii) Causal/Non Causal

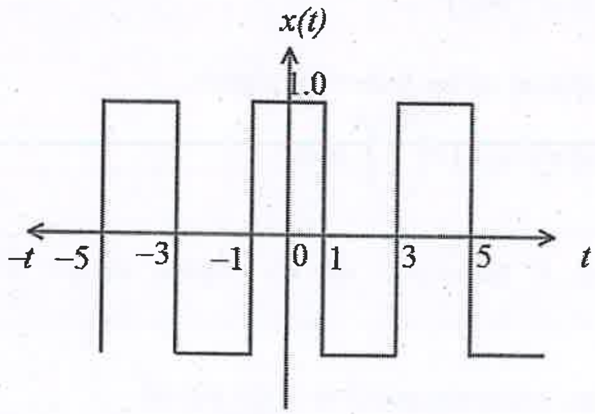
(iv) Time Invariant/ Time Variant

(1) $y(t)\frac{d^2y(t)}{dt^2}+\frac{3tdy(t)}{dt}+y(t)=x(t)$

(2) $y(n)=x(n)x(n-1)$

(3) $y(n)=\cos\left[x(n)\right]$

29. a. Find the trigonometric Fourier series for the periodic signal shown below



(OR)

b. State and derive the following properties of Fourier transform

(i) Convolution theorem

(ii) Differentiation in time

(iii) Parseval's energy theorem

30. a. Determine the complete response of the system described by the equation $\frac{d^2y(t)}{dt^2}+4\frac{dy(t)}{dt}+4y(t)=\frac{dx(t)}{dt}+x(t)$ when the initial conditions are $y(0^+)=\frac{9}{4}$; $\frac{dy(0^+)}{dt}=5$ and when the input is $e^{-3t}u(t)$.

(OR)

b.i. List the steps for convolution of 2 signals using graphical method.

ii. Find the convolution of the following signals using graphical method $x(t)=e^{-2t}u(t);\ h(t)=u(t+2)$

31. a. For the given system $y(n)-1.5y(n-1)+0.5y(n-2)=x(n)$ with initial conditions $y(-1)=1,\ y(-2)=0$. Find the response due to input signal $x(n)=2^n u(n)$.

(OR)

b.i. State and prove the circular time shifting property of DFT. (4 Marks)

ii. Using concentric circle method find the circular convolution of the sequences $x_1(n)=\{\underset{\uparrow}{1},-1,2,3\}$, $x_2(n)=\{\underset{\uparrow}{0},1,2,3\}$. Verify the answer using matrix method. (8 Marks)

32. a. Using partial fraction method, find the inverse z-transform of the following

(i) $X(z)=\frac{\frac{1}{4}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$; ROC $|z|>\frac{1}{2}$

(ii) $X(z)=\frac{1}{1-z^{-1}+z^{-2}}$; ROC $|z|>1$

(OR)

b. Obtain Direct form I and Direct form II realization for the system described by the difference equation $y(n)-\frac{5}{6}y(n-1)+\frac{1}{6}y(n-2)=x(n)+2x(n-1)$

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