Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
First to Eighth Semester

15EC205 – SIGNALS AND SYSTEMS
(For the candidates admitted during the academic year 2015 – 2016 to 2017 – 2018)

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. A signal $x(t) = A\cos(\Omega_0 t + \phi)$ is
   (A) An energy signal
   (B) A power signal
   (C) An energy as well as a power signal
   (D) Neither an energy nor a power signal

2. A period of the function $\cos\frac{\pi}{4}(t-1)$ is
   (A) 1/8 sec
   (B) 8 sec
   (C) 4 sec
   (D) 1/4 sec

3. The system $y(t) = x(3t-6)$ is
   (A) Linear, time variant
   (B) Linear, time invariant
   (C) Nonlinear, time invariant
   (D) Nonlinear, time variant

4. The system $y(t) = e^{x(t)}$ is
   (A) Stable, causal
   (B) Non causal, stable
   (C) Unstable, causal
   (D) Unstable, non causal

5. If the Fourier series coefficients of *x(t)* are C_n, then the Fourier series coefficients of *x(–t)* is given by
   (A) C_n^*
   (B) C_{-n}
   (C) C_{-n}^*
   (D) C_n

6. The periodic signal is said to have half symmetry when
   (A) $x(t) = x\left(t + \frac{T}{2}\right)$
   (B) $x(t) = x\left(t - \frac{T}{2}\right)$
   (C) $x(t) = -x\left(t \pm \frac{T}{2}\right)$
   (D) $x(t) = x\left(t \pm \frac{T}{2}\right)$

7. The inverse Fourier transform of the function $F(j\Omega) - \frac{1}{j\Omega} + \pi\delta(\Omega)$
   (A) $\sin\Omega t$
   (B) $\cos\Omega t$
   (C) sgn(t)
   (D) u(t)

8. If $x(t)$ is odd then $x(j\Omega)$

(A) Imaginary and odd
(B) Imaginary and even
(C) Real and odd
(D) Real and even

9. Which of the following response of an LTI system depends on initial conditions?

(A) Natural response
(B) Forced response
(C) Zero state response
(D) Step response

10. If $L[f(t)] = F(s)$ then $L[f(t-T)]$ is equal to

(A) $e^{sT}F(s)$
(B) $e^{-sT}F(s)$
(C) $\dfrac{F(s)}{1+e^{sT}}$
(D) $\dfrac{F(s)}{1-e^{-sT}}$

11. The final value of $L^{-1}\left[\dfrac{2s+1}{s^4+8s^3+16s^2+s}\right]$ is

(A) ∞
(B) 2
(C) 1
(D) Zero

12. The Laplace transform of unit ramp function staring at t=a is

(A) $\dfrac{1}{(s+a)^2}$
(B) $\dfrac{e^{-as}}{(s+a)^2}$
(C) $\dfrac{e^{-as}}{s^2}$
(D) $\dfrac{a}{s^2}$

13. According to Parseval's theorem $\sum_{n=0}^{N-1} |x(n)|^2 =$

(A) $\sum_{k=0}^{N-1} |X(k)|^2$
(B) $\sum_{k=-\alpha}^{\alpha} |X(k)|^2$
(C) $\frac{1}{N}\sum_{k=0}^{N-1} |X(k)|^2$
(D) $|X(k)|^2$

14. The DFT of the sequence $x(n)=\delta(n-n_0)$ is

(A) 1
(B) $e^{j2\pi Kn_0}$
(C) $e^{-j2\pi n_0 K/N}$
(D) $e^{j2\pi n_0 K/N}$

15. The discrete Fourier transform of $x^*[n]$ is

(A) $x^*[k]$
(B) $x^*[-k]$
(C) $x^*[N-k]$
(D) $x[N-k]$

16. The DTFT of the sequence $x(n)=\delta(n-2)+\delta(n+2)$ is

(A) $\cos 2\Omega$
(B) $2\cos 2\Omega$
(C) $2\sin 2\Omega$
(D) $\sin 2\Omega$

17. The region of convergence of Z-transform of the sequence $\left(\frac{5}{6}\right)^n u(n)-\left(\frac{6}{5}\right)^n u(-n-1)$ must bc

(A) $|z|<\frac{5}{6}$

(B) $|z|>\frac{6}{5}$

(C) $\frac{5}{6}<|z|<\frac{6}{5}$

(D) $\frac{6}{5}<|z|<\infty$

18. The Z-transform of $x(n)=\delta(n)$ is

(A) 1

(B) $\frac{1}{1-z^{-1}}$

(C) $\frac{1}{1-z}$

(D) $\frac{1}{1+z}$

19. The Z-transform of the following real exponential sequence $x(n)=a^n n\geq 0;\ x(n)=0,$ $for\ n<0$ is given by

(A) $1-az^{-1};|z|>a$

(B) $\frac{1}{1-az^{-1}};|z|>a$

(C) $-\frac{1}{1-az};|z|>a$

(D) $1+az^{-1};|z|<a$

20. If the function $H_1(z)=1+1.5z^{-1}-z^{-2}$ *and* $H_2(z)=z^2+1.5z-1$ then

(A) The poles and zeros of the functions will be the same

(B) The poles of the functions will be identical but not zero

(C) The zeros of the functions will be identical but not the poles

(D) Neither the poles nor the zeros of the two function will be identical

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

21. Determine the even and odd components $x(t)=\cos t+\sin t+\cos t\sin t$.

22. Sketch the signal $x(t)=r(t)-2r(t-1)+r(t-2)$.

23. Find the Fourier transform of the signal $x(t)=\cos(\Omega_0 t)$.

24.i. State the Dirichlet's condition.

ii. Find the inverse Fourier transform of $x(j\Omega)=\delta(\Omega)$.

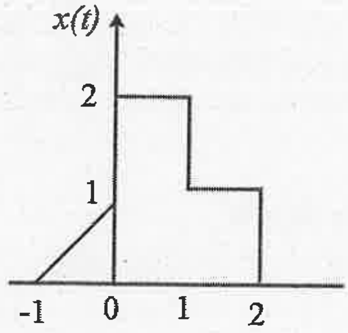
25. Determine the initial value $x\left(O^+\right)$ for the Laplace transforms $X(s)=\frac{2s+3}{s\left(s^2+5s+6\right)}$.

26. Find the IDFT of the following function. $X(k)=\{2,0,1,0\}$.

27. Write the properties of region of convergence in Z-transform.

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

28. a. A time signal shown below.



Sketch and label carefully each of the following signals.

(i) $x(t-3)$
(ii) $x(3t+4)$
(iii) $x\left(\frac{4t}{3}\right)$
(iv) $x(-t+4)$

(OR)

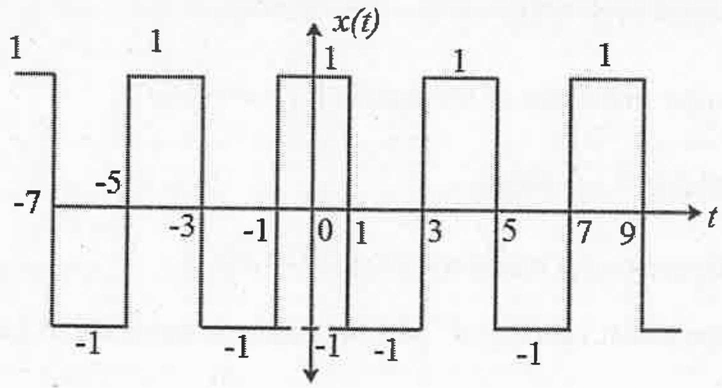
b.i. Determine the energy and power of the following signals.

(a) $x(t) = tu(t)$
(b) $x(n) = 2e^{j3\pi n}$

ii. Check whether the following systems.

$y(t) = od\{x(t)\}$
$y(n) = \cos[x(n)]$
are (i) static (or) dynamic (ii) linear (or) non linear

29. a. For the signal shown below, determine the trigonometric Fourier series for the periodic signal *x(t)*.



(OR)

b. State and derive the following properties of Fourier transform.

(i)	Time reversal	(2 Marks)
(ii)	Time shifting	(2 Marks)
(iii)	Time differentiation	(4 Marks)
(iv)	Convolution theorem	(4 Marks)

30. a. Determine the complete response of the system described by the equation.

$$\frac{d^2y(t)}{dt^2}+\frac{3dy(t)}{dt}+2y(t)=\frac{d}{dt}x(t) \text{ if } y(0^-)=2;\frac{dy(0^-)}{dt}=1 \; and \; x(t)=e^{-t}u(t)$$

(OR)

b.i. Find the Laplace transform of the signal $x(t)=e^{-at}u(t)+e^{-bt}u(-t)$ and find ROC. What are pole locations?

ii. Find the inverse Laplace transform of the following. $X(s)=\frac{3s^2+8s+6}{(s+2)(s^2+2s+1)}$.

31. a. Find four point DFT of the following sequences.

(i) $x(n)=\{1,-2,3,4\}$

(ii) $x(n)=\sin\frac{n\pi}{2}$

(OR)

b. Determine the response of the LTI system using convolution sum whose input x[n] and impulse response *h(n)* are given by $x(n)=\{1,\underset{\uparrow}{4},3,2\} \; and \; h(n)=\{1,\underset{\uparrow}{2},3-1\}$

32. a. Using long division, determines the inverse z-transform of $X(z)=\frac{1+2z^{-1}}{1-2z^{-1}+z^{-2}}$, when

(i) *x(n)* is causal

(ii) *x(n)* is anticausal

(OR)

b. Find the direct form I and direct form II structure form for $y(n)-\frac{5}{6}y(n-1)+\frac{1}{6}y(n-2)=x(n)+2x(n-1)$.

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