Reg. No.														

B.Tech. DEGREE EXAMINATION, NOVEMBER 2018
3rd to 7th 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. 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. Which of the following is a time invariant system?
   (A) $y(t)=tx(t)$
   (B) $y(t)=e^{x(t)}$
   (C) $y(t)=x(-t)$
   (D) $y(t)=x(t^2)$

3. The unit step signal $u(n)$ delayed by 3 units of time is denoted as
   (A) $u(n+3)=1;\ n\geq 3$; $=0;\ n<3$
   (B) $u(3-n)=1;\ n\geq 3$; $=0;\ n<3$
   (C) $u(n-3)=1;\ n\geq 3$; $=0;\ n<3$
   (D) $u(3n)=1;\ n>3$; $=0;\ n<3$

4. Which of the following system is causal?
   (A) $h(n)=n\left(\frac{1}{2}\right)^n u(n+1)$
   (B) $y(n)=x^2(n)-x(n+1)$
   (C) $y(n)=x(-n)+x(2n-1)$
   (D) $h(n)=n\left(\frac{1}{2}\right)^n u(n)$

5. Fourier series of any periodic signal $x(t)$ can only be obtained of
   (A) Finite number of discontinuities within finite time interval, T
   (B) Finite number of positive and negative maxima in the period, T
   (C) Well defined at infinite number of points
   (D) Both A and B

6. In Fourier series representation of a signal, if Ω_0 is the fundamental frequency then $n\Omega_0$ are called
   (A) Periodic frequencies
   (B) Aperiodic frequencies
   (C) Harmonic frequencies
   (D) Both A and B

7. Fourier transform of $\cos\Omega_0 t$ is
   (A) $X(\Omega-\Omega_0)+X(\Omega+\Omega_0)$
   (B) $\pi[\delta(\Omega-\Omega_0)+\delta(\Omega+\Omega_0)]$
   (C) $\frac{\pi}{2}[\delta(\Omega-\Omega_0)+\delta(\Omega+\Omega_0)]$
   (D) $X(\Omega-\Omega_0)-X(\Omega+\Omega_0)$

8. If Fourier transform of $x_1(t)$ is $\frac{a}{\Omega - a}$ and Fourier transform of $x_2(t)$ is $\frac{a}{\Omega + a}$, then $F\{x_1(t) * x_2(t)\}$ is,

(A) $\frac{\Omega - a}{\Omega + a}$

(B) $\frac{\Omega + a}{\Omega - a}$

(C) $\frac{a^2}{\Omega^2 + a^2}$

(D) $\frac{a^2}{\Omega^2 - a^2}$

9. Which of the following impulses responses of LTI systems represents a stable system?

(A) $h(t) = e^t \cos t u(t)$

(B) $h(t) = e^t \sin t u(t)$

(C) $h(t) = e^{-t} \cos t u(t)$

(D) $h(t) = t \sin t u(t)$

10. Which of the following represents the convolution of two causal signals $x_1(t)$ *and* $x_2(t)$?

(A) $\int_{t=0}^{\lambda} x_1(t) x_2(\lambda - t) dt$

(B) $\int_{t=0}^{\lambda} x_1(t) x_2(t - \lambda) dt$

(C) $\int_{t=0}^{\lambda} x_2(\lambda) x_1(\lambda - t) dt$

(D) $\int_{t=0}^{\lambda} x_2(\lambda) x_1(\lambda - t) dt$

11. The ROC of a causal signal $x(t)$ is

(A) Entire S-plane

(B) Right of abscissa of convergence

(C) Region in between two abscissa of convergence

(D) Left of abscissa of convergence

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

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

(B) $x(t) = e^{-2t} \cos 5t$

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

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

13. The Fourier transform of $x(n) = 1$, for all 'n' is

(A) $2\pi \sum_{m=-\infty}^{\infty} \delta(\omega - 2\pi m)$

(B) $\pi \sum_{m=-\infty}^{\infty} \delta(\omega - 2\pi m)$

(C) $2\pi \sum_{m=-\infty}^{\infty} \delta(\omega - m)$

(D) $\pi \sum_{m=-\infty}^{\infty} \delta(\omega - m)$

14. The discrete time Fourier transform of the signal, $x(n) = 0.5^{(n-1)} u(n-1)$ is

(A) $e^{-j\omega}\left(1 - 0.5e^{-j\omega}\right)$

(B) $\frac{0.5e^{-j\omega}}{1 - 0.5e^{-j\omega}}$

(C) $\frac{0.5e^{j\omega}}{1 - 0.5e^{-j\omega}}$

(D) $\frac{e^{-j\omega}}{1 - 0.5e^{-j\omega}}$

15. The DFT of product of two discrete time sequence is $x_1(n)$ *and* $x_2(n)$ is equivalent to

(A) $\frac{1}{N}\left[x_1(k).x_2(k)\right]$

(B) $\frac{1}{N}\left[x_1(k) \circledast x_2(k)\right]$

(C) $\frac{1}{N}\left[x_1(k) \circledast x_2^*(k)\right]$

(D) $x_1(k) \circledast x_2(k)$

16. For a system, $y(n)=nx(n)$, the inverse system will be

(A) $y\left(\frac{1}{n}\right)$ (B) $\frac{1}{n}y(n)$

(C) $ny(n)$ (D) $n^{-1}y(n)$

17. For a stable LTI discrete time system poles should lie

(A) Outside unit circle (B) Inside unit circle

(C) On the unit circle (D) Either B or C

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

(A) No ROC (B) $-1<|z|<1$

(C) $|z|>1$ (D) $|z|<1$

19. The inverse z-transform of $\frac{3}{z-4}$, $|z|>4$ is,

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

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

20. The z-transform is a

(A) Finite series (B) Infinite power series

(C) Geometric series (D) Both A and C

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

21. Find whether the given signal is energy signal, power signal, neither energy nor power signal and justify $x(n)=\left(\frac{2}{3}\right)^{n}u(n)$.

22. Find the period of the following signals

(i) $x(n)=e^{j2\pi\frac{n}{3}}+e^{j3\pi\frac{n}{4}}$

(ii) $x(t)=2u(t)+2\sin 2t$

23. Find the Fourier series co-efficient of the given continuous time signal $x(t)=\cos\left(2t+\frac{\pi}{4}\right)$.

24. Find the Fourier transform of the continuous time signal $x(t)=te^{-3t}u(t)$.

25. Find the inverse laplace transform of $X(s)=\frac{2}{(s+4)(s-1)}$ if the region of convergence is $\mathrm{Re}(s)<-4$.

26. Consider two discrete time signals of $x_1(n)$ *and* $x_2(n)$, find the discrete time Fourier transform of $x_1(n)*x_2(n)$.

27. Obtain the direct form-I realization for the system described by the difference equation

$$y(n)-\frac{5}{6}y(n-1)+\frac{2}{3}y(n-2)=x(n)+3x(n-1)$$

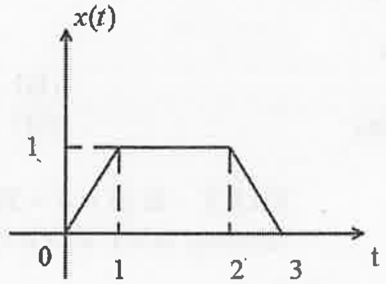
PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. Check whether the following systems are
   (i) Static/dynamic
   (ii) Linear/non linear
   (iii) Time invariant/time variant
   (iv) Causal/non causal
   (1) $y(n) = Sgn[x(n)]$
   (2) $\frac{d^3y(t)}{dt^3} + \frac{4d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 2y^2(t) = x(t)$

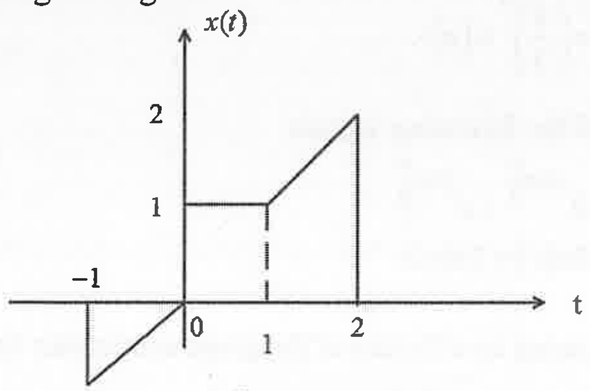
(OR)

b.i. Sketch the signal $\pi\frac{(t-1)}{2} + \pi(t-1)$

ii. A continuous time signal is shown below. Perform the given operations on the signal.
   (1) $x\left(\frac{2}{3}t-1\right)$
   (2) $3x(-2t+2)$



iii. Sketch the odd part of the given signal



29. a. By using the classical method, solve $\frac{d^2y(t)}{dt^2} + \frac{4dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} + x(t)$, if the initial conditions are $y(0^+) = \frac{9}{4}, \frac{d}{dt}y(0^+) = 5$ and if the input is $e^{-3t}u(t)$.

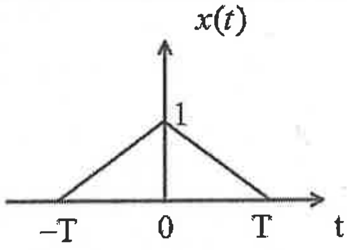
(OR)

b. Solve the following differential equations by using Laplace transform
$\frac{d^3y(t)}{dt^3} + \frac{7d^2y(t)}{dt^2} + \frac{16dy(t)}{dt} + 12y(t) = x(t)$, if $\frac{d}{dt}y(0^-) = 0$, $\frac{d^2y(0^-)}{dt^2} = 0$, $y(0^-) = 0$ and $x(t) = \delta(t)$.

30. a. Find the cosine Fourier series of half wave rectified sine function with period 2π and amplitude 'A'.

(OR)

b. Determine the Fourier transform of the triangular pulse shown below.



31. a. Find the response of the system with difference equation $y(n)+2y(n-1)+y(n-2)=x(n)+x(n-1)$ for the input $x(n)=\left(\frac{1}{2}\right)^n u(n)$ with initial conditions $y(-1)=y(-2)=1$.

(OR)

b.i. Determine convolution sum of two sequences using graphical method (8 Marks)

$x(n)=\{1,\underset{\uparrow}{4},3,2\}$, $h(n)=\{1,3,2,1\}$

ii. Compute 4-point DFT of the sequence $x(n)=\{0,-1,2,1\}$.

32. a. Determine all possible signals $x(n)$ associated with z-transform

$$X(z)=\frac{5z^{-1}}{\left(1-2z^{-1}\right)\left(1-3z^{-1}\right)}$$

(OR)

b. Realize the system given by difference equation

$y(n)-\frac{1}{4}y(n-1)-\frac{1}{8}y(n-2)=x(n)+3x(n-1)+2x(n-2)$ in cascade and parallel form.

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