- b. Find the fourier transform of a triangular pulse.
- differential 30. a. A system is described following  $\frac{d^2y(t)}{dt} + 7\frac{dy(t)}{dt} + 12y(t) = x(t)$  determine the response of the system to a unit step applied at t = 0. The initial conditions are y(0) = -2;  $\frac{dy(0)}{dt} = 0$ .

b.i. Find the inverse Laplace transform for  $\frac{\left(1+e^{-2s}\right)}{\left(3s^2+2s\right)}$ 

- ii. Obtain the transfer function of the system if  $y(t) = e^{-t} 2e^{-2t} + e^{-3t}$  and  $x(t) = e^{-0.5t}$ .
- 31. a. Find the 8-point DFT of the following sequence  $x(n) = \{1, -1, 1, -1, 1, -1, 1, -1\}$

(OR)

b. Consider a causal and stable LTI system whose input x(n) and output y(n) are related through the second order difference equation

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

- Determine the frequency response  $H(e^{j\omega})$  for the system
- Determine the impulse response h(n) for the system.
- 32. a. Using z-transform, find the output y(n) of a LTI discrete time system specified by the given equation  $y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = 2x(n) + \frac{3}{2}x(n-1)$ , when the initial conditions are y(-1) = 0, y(-2) = 1 and input  $x(n) = \left(\frac{1}{4}\right)^n u(n)$ .

b. Obtain the Direct Form I, II cascade and parallel form realization for the system y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2).

|          | 1 | 0.00 | 0.0 |   |  |      |  |      |  |
|----------|---|------|-----|---|--|------|--|------|--|
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## **B.Tech. DEGREE EXAMINATION, MAY 2019**

Third Semester



EC1008 - SIGNALS AND SYSTEMS

(For the candidates admitted during the academic year 2013 - 2014 and 2014 - 2015)

Note:

- 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.
- Part B and Part C should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

## $PART - A (20 \times 1 = 20 Marks)$ Answer ALL Questions

- 1. The period of the function  $\cos \frac{\pi}{4}(t-1)$  is
  - $\frac{1}{8}$ sec

(B) 8 sec

(C) 4 sec

- 2. A signal  $x(t) = A\cos(\omega_0 t + \phi)$  is
  - (A) A power signal

- (B) An energy signal
- (C) An energy as well as a power signal
- (D) Neither an energy nor a power signal
- 3. Which one of the following systems is a causal system?
  - (A)  $y(t) = \sin[u(t+3)]$

- (B) v(t) = 5u(t) + 3u(t+1)
- (C)  $y(t) = \sin \left[ u(t-3) \right] + \sin \left[ u(t+3) \right]$  (D) y(t) = 5u(t) + 3u(t-1)
- 4. The system y(t) = x(3t-6) is
  - (A) Linear, time invariant
- (B) Linear, time variant
- (C) Non linear, time variant
- (D) Non linear, time invariant
- 5. Periodic function of the half-wave symmetry is necessarily
  - (A) An even function

- (B) An odd function
- (C) Neither odd nor even
- (D) Both odd and even
- 6. If from the function x(t) one forms the function  $\psi(t) = x(t) + x(-t)$  then  $\psi(t)$  is
  - (A) Even

- (B) Odd
- (C) Neither odd nor even
- (D) Both odd and even
- 7. The Fourier transform of the function sgn(t) is
  - (A)

- The inverse Fourier transform of the function  $X(j\omega) = \frac{1}{j\omega} + \pi\delta(\omega)$
- (A)  $\sin \omega t$

(C)  $\sin(t)$ 

(D) u(t)

| 9.  |      | t is the Laplace transform of a delayed                 | unit        | impulse function $\delta(t-1)$ ?                   |
|-----|------|---|-------------|--|
|     | (A)  |   | ` '         | Zero   |
| 1.0 |      | exp(-s)   | (D)         |  |
| 10. |      | Laplace transform of $e^{at}\cos(bt)$ is eq             |             |  |
|     | (A)  | $\frac{s+a}{2}$   | (B)         | $\frac{s-a}{\left(s-a\right)^2+b^2}$               |
|     |      | $\frac{(s+a)^2 + b^2}{s-a}$ $\frac{s-a}{(s+a)^2 + b^2}$ |             | $(s-a)^2+b^2$                                      |
|     | (C)  | $\frac{s-a}{2}$   | (D)         | $\frac{s+a}{(s-a)^2}$                              |
|     |      | $(s+a)^2+b^2$   |             | $(s-a)^2$  |
| 11. | The  | impulse response of a system is $h(t) =$                | $\delta(t-$ | -0.5). If two such systems are cascaded, the       |
|     |      | alse response of the overall system will                |             |  |
|     |      | $0.5\delta\big(t-0.25\big)$                             | (B)         | $\delta(t-0.25)$                                   |
|     | (C)  | $\delta(t-1)$   | (D)         | $0.5\delta(t-1)$                                   |
| 12. | A go | ood measure of similarity between two                   | signa       | $1 x_1(t)$ and $x_2(t)$ is                         |
|     |      | Convolution   |             | Correlation  |
|     | (C)  | Power density spectrum                                  | (D)         | Fourier transform                                  |
| 13. |      | direct evaluation DFT requires                          |             | _ complex multiplications                          |
|     |      | N(N-1)  | (B)         |  |
|     | (C)  | N(N+1)  | (D)         | $\frac{N(N-1)}{2}$                                 |
| 1/  | T)   | 1   |             | 2  |
| 17. |      | discrete Fourier transform of $x^*(n)$ is               | (D)         | * /  |
|     |      | $x^*(k)$  |             | $x^*(-k)$  |
|     | (C)  | x(N-k)  | (D)         | $x^*(N-k)$   |
| 15. |      | ch of the following systems are casual?                 |             |  |
|     | (A)  | $h(n) = \left(\frac{1}{2}\right)^n u(n)$                | (B)         | $h(n) = a^n u(-n)$                                 |
|     | (0)  | (-/   | (Table )    |  |
|     | (C)  | $h(n) = \cos \pi n$                                     | (D)         | $h(n) = \sin(n\pi/4)$                              |
| 16. | The  | linear convolution of $x(n) = \{1, 2, 3\}$ ar           | •           |  |
|     | (A)  | $y(n) = \{4,13,28,27,18\}$                              | (B)         | $y(n) = \{4,23,28,7,18\}$ $y(n) = \{4,13,2,27,8\}$ |
|     | (C)  | $y(n) = \{14,13,2,27,18\}$                              | (D)         | $y(n) = \{4,13,2,27,8\}$                           |
| 17. | The  | region of convergence of the Z-transfor                 | m of        | a unit step function is                            |
|     |      | z  > 1  |             | z  < 1   |
|     | ` '  | (Real part of z)>0                                      | ` '         | (Real part of z)<0                                 |
| 18. |      | region of convergence of Z-transform of                 |             |  |
|     | (I)  | Zeros   | (B)         | Poles  |

(D) Roots

(B)  $\delta(n-m)$ 

(D)  $\delta(m-n)$ 

19. Which one of the following represents the impulse response of a system defined by

20. The minimum number of delay elements required in realizing a digital filter with the transfer function  $H(z) = \frac{1 + az^{-1} + bz^{-2}}{1 + az^{-1} + dz^{-2} + az^{-3}}$ 

(A) 2

(B) 3

(C) 4

(D) 5

## $PART - B (5 \times 4 = 20 Marks)$ Answer ANY FIVE Questions

- 21. Sketch the following signals
  - (i) x(t) = 2u(t-1)
  - (ii) x(t) = 3r(t-1)
- 22. Evaluate the following integrals

(i) 
$$\int_{-\alpha}^{\alpha} e^{-at^2} \delta(t-10) dt$$

(ii) 
$$\int_{-\alpha}^{\alpha} \left[ \delta(t) \cos t + \delta(t-1) \sin t \right] dt$$

- 23. State and prove Parseval's relation in Fourier series.
- Determine the response of an LTI system with impulse response  $h(t) = e^{-2t} u(t)$  for the input  $x(t) = \cos 10t$  using Fourier transform.
- 25. State initial value and final valve theorem for Laplace transform.
- 26.(i) State the condition for the existence of DTFT.
- (ii) Find the DTFT for the signal x(n) = u(n-k).
- 27. Using Z-transform, find the convolution of two sequences  $x_1(n) = \{1, 2, -1, 0, 3\}$ ,  $x_2(n) = \{1, 2, -1\}$ .

## PART - C (5 × 12 = 60 Marks) Answer ALL Questions

- 28. a.i. Test whether the signal is periodic or not
  - $(1) \quad x(t) = te^{\sin(t)}$
  - (2)  $x(t) = 2\cos(10t+1) \sin(4t-1)$
  - ii. Find the energy and power of the signal
    - $(1) \quad x(t) = tu(t)$
    - $(2) \quad x(n) = 2e^{j3\pi n}$

(OR)

- b. Check whether the given systems are static, causal, time invariant, linear and stable or not
  - $(1) \quad y(t) = oddx(t)$
  - (2)  $y(n) = \cos[x(n)]$
- 29. a. Obtain the trigonometric fourier series representation of a half wave recitifer.

(OR)

(C) Complex values

 $H(z) = z^{-m}$ ?

(A)  $\mu(n-m)$ 

(C)  $\delta(m)$