# University of Mumbai

## Examination 2021 under cluster 5 (Lead College: APSIT)

**Examinations Commencing from 1st June 2021 to 11th June 2021.**

Program: Electronics and Telecommunication Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester IV

Course Code: ECC 404 and Course Name: Signals and Systems

Time: 2 hour Max. Marks: 80

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| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
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| | |
| 1. | Which of the following responses of an LTI system does not depend on initial conditions? |
| Option A: | Natural response |
| Option B: | free response |
| Option C: | forced response |
| Option D: | total response |
| | |
| 2. | Which of the following is an energy signal? |
| Option A: | $x(t)=A\ e^{j\Omega t}$ |
| Option B: | $x(t)=A \sin \Omega t$ |
| Option C: | $x(t)=B \cos \Omega t$ |
| Option D: | $x(t)=e^{-at}\ u(t)$ |
| | |
| 3. | The Fourier transform of a function is equal to its two-sided Laplace transform evaluated ____ |
| Option A: | On the real axis of the s-plane |
| Option B: | On the line parallel to the real axis of the s-plane |
| Option C: | On the imaginary axis of the s-plane |
| Option D: | On the line parallel to the imaginary axis of the s-plane |
| | |
| 4. | The Fourier transform of a $x(t)= e^{7t}\ u(-t)$ function is given as: |
| Option A: | $F(j\omega) = 1/(7+j\omega)$ |
| Option B: | $F(j\omega) = 7/(1+j\omega)$ |
| Option C: | $F(j\omega) = 7/(1-j\omega)$ |
| Option D: | $F(j\omega) = 1/(7-j\omega)$ |
| | |
| 5. | Find the Z-transform of $\delta(n+3)$. |
| Option A: | 1 |
| Option B: | z |
| Option C: | $z^2$ |
| Option D: | $z^3$ |
| | |
| 6. | Find the Z-transform of u(-n). |
| Option A: | 1/(1-z) |
| Option B: | 1/(1+z) |
| Option C: | z/(1-z) |
| Option D: | z/(1+z) |

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| 7. | For what kind of signals one sided z-transform is unique? |
| Option A: | All signals |
| Option B: | Anti-causal signal |
| Option C: | Causal signal |
| Option D: | Non-causal |
| | |
| 8. | What is the one-sided z-transform of x(n)=δ(n-k)? |
| Option A: | 0 |
| Option B: | 1 |
| Option C: | $z^{-k}$ |
| Option D: | $z^{k}$ |
| | |
| 9. | Linear convolution between two sequences $x_1(n) = \{\underset{\uparrow}{-1},1,2,-2\}$ and $x_2(n) = \{0.5,\underset{\uparrow}{1},-1,2,0.75\}$ is |
| Option A: | $\{-0.3, \underset{\uparrow}{-0.6}, 3, -2, -2.75, 6.75, -2.5, -1.6\}$ |
| Option B: | $\{-0.1, \underset{\uparrow}{-0.5}, 3, -4, -2.75, 9.75, -2.5, -1.5\}$ |
| Option C: | $\{-0.5, \underset{\uparrow}{-0.5}, 3, -2, -2.75, 6.75, -2.5, -1.5\}$ |
| Option D: | $\{-0.5, \underset{\uparrow}{-0.4}, 1, -2, -2.75, 6.75, -2.5, -1.5\}$ |
| | |
| 10. | Find the final value, x(∞) in time domain for the s-domain signal $X(s)=s/(s^2+4)$. |
| Option A: | 0 |
| Option B: | 1 |
| Option C: | 0.25 |
| Option D: | 1.25 |
| | |
| 11. | The convolution of u(n) with u(n-4) at n=5 is |
| Option A: | 5 |
| Option B: | 2 |
| Option C: | 1 |
| Option D: | 0 |
| | |
| 12. | The samples of a cosine wave at zero frequency are equivalent to samples of |
| Option A: | Sine wave |
| Option B: | A DC signal |
| Option C: | A cosine wave |
| Option D: | An unknown signal |
| | |
| 13. | Determine whether the signal, $x(t)=3\cos\sqrt{2}\,t + 7\cos 5\pi t$ is periodic or not |
| Option A: | Non-Periodic |
| Option B: | Periodic |
| Option C: | Rational |
| Option D: | Irrational |
| | |

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|---|---|
| 14. | If input to a system is not bounded , then system is |
| Option A: | stable |
| Option B: | Unstable |
| Option C: | Cannot be tested |
| Option D: | ideal |
| | |
| 15. | Which one of the following systems is causal? |
| Option A: | $y(t)=x(t)+x(t-3)+x(t^2)$ |
| Option B: | $y(n)=x(n+2)$ |
| Option C: | $y(t)=x(t-1)+x(t-2)$ |
| Option D: | $y(n)=x(2n^2)$ |
| | |
| 16. | Find the Nyquist rate and Nyquist interval for the signal $f(t)=(\sin 500\pi t) / \pi t$. |
| Option A: | 500 Hz, 2 sec |
| Option B: | 500 Hz, 2 msec |
| Option C: | 2 Hz, 500 sec |
| Option D: | 2 Hz, 500 msec |
| | |
| 17. | The impulse response h (t) of an LTI system is given by $e^{-2t}$ u(t). What is the step response? |
| Option A: | $y(t) = \frac{1}{2} (1 – e^{-2t}) u (t)$ |
| Option B: | $y(t) = \frac{1}{2} (1 – e^{-2t})$ |
| Option C: | $y(t) = (1- e^{-2t}) u (t)$ |
| Option D: | $y(t) = \frac{1}{2} (e^{-2t}) u (t)$ |
| | |
| 18. | Fourier transform is evaluation of Laplace transform along the _____ axis in s-plane. |
| Option A: | Real |
| Option B: | Imaginary |
| Option C: | Z domain |
| Option D: | S domain |
| | |
| 19. | Determine the convolution of $x_1(t)= e^{-2t} u(t)$ and $x_2(t)=e^{-6t} u(t)$, using Fourier Transform? |
| Option A: | $0.25(e^{-2t} – e^{-6t}) u(t)$ |
| Option B: | $0.15(e^{-2t} – e^{-6t}) u(t)$ |
| Option C: | $0.25(e^{-3t} – e^{-6t}) u(t)$ |
| Option D: | $0.35(e^{-2t} – e^{-5t}) u(t)$ |
| | |
| 20. | In IIR systems, the _____ structure will give direct relation between time domain and z domain. |
| Option A: | Direct form-I |
| Option B: | Direct form |
| Option C: | Linear phase |
| Option D: | Direct form-II |

| **Q2** | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | State and prove any two properties of Fourier Transform. |
| B | Determine the following systems are memory less, causal, linear or Time invariant $y(t)=5x(t)+2$ |
| C | Using Laplace Transform, determine the natural response of the system represented by the following equations. $(d^2y(t)/dt^2) + 10\,(dy(t)/dt) + 21\,y(t) = 8\,x(t)$ , $y(0)=2$, $(dy(t)/dt) = -3$ at $t=0$ |
| D | Explain in brief the ROC conditions in Laplace Transform. |
| E | Determine the autocorrelation of the CT signal given by $x(t)=A\ rect\ (t/2)$. |
| F | The Impulse response of DT system is given by $h[n]= \{1,2,3\}$ and the output response is given by $y[n]= \{1,1,2,-1,3\}$, Using Z-Transform, determine x[n] by long division method. |

| **Q3.** **(20 Marks Each)** | **Solve any Two Questions out of Three** **10 marks each** |
|---|---|
| A | Consider a causal LTI system with $H(j\omega) = (j\omega+2)^{-1}$. For a particular input $x(t)$, this system produces output $y(t)=e^{-2t}\,u(t)-e^{-3t}\,u(t)$. Find out $x(t)$ using Fourier Transform. |
| B | A LTI system has the following transfer function $$H(z) = \frac{z}{(z-\frac{1}{4})(z+\frac{1}{4})(z-\frac{1}{2})}$$ Give all possible ROC condition<br>a) Show pole-zero diagrams<br>b) Find impulse response of system<br>c) Comment on the system stability and causality for all possible ROC's |
| C | Obtain Inverse Laplace Transform of the function $X(s)=(3s+7)/(s^2-s-12)$ for following ROCs, also comment on the stability and causality of the systems for each of the ROC conditions.<br>Support your answer with appropriate sketches of ROCs.<br>i. $Rs(s)>4$<br>ii. $Re(s)<-3$ |