University of Mumbai Examination Summer 2022

Time : 2 hours 30 minutes ECC404:SIGNALS AND SYSTEM Max. Marks :80

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| Q1. | Choose the correct option for the following questions . All the questions are compulsory and carry equal marks. |
| 1. | A discrete signal is said to be even or symmetric if x(-n) is equal to |
| Option A | x(n) |
| Option B | –x(n) |
| Option C | –x(-n) |
| Option D | 0 |
| 2. | Under what conditions the three signals x(t), y(t) and z(t) with period t1 t2 and t3 respectively are periodic? |
| Option A | t1/t2/t3= rational |
| Option B | All the ratios of the three periods in any order is rational |
| Option C | t1/t2 is rational |
| Option D | t1/t2= t2/t3 |
| 3. | What is the period of the signal: 2cost/6? |
| Option A | 16π |
| Option B | 10π |
| Option C | 8π |
| Option D | 12π |
| 4. | After converting the input and output to a dummy variable, the next step of convolution is |
| Option A | Shift the impulse response |
| Option B | Changing the dummy variables |

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| Option C | Shifting any one of the signals to left side i.e towards the negative direction |
| Option D | Shift the input |
| 5. | The continuous time system described by the equation y(t) = x(t^2) comes under which category |
| Option A | causal, linear and time varying |
| Option B | non causal, linear and time-variant |
| Option C | non causal, non-linear and time-invariant |
| Option D | causal, non-linear and time varying |
| 6. | Find auto correlation of x(n)= { 1,2,3,4} |
| Option A | 4, 11, 20, 30, 11, 20, 4 |
| Option B | 4, 11, 20, 30, 20, 11, 4 |
| Option C | 4, 20, 3, 5, 11, 2, 4 |
| Option D | 4, 2, 11, 5, 3 ,20, 4 |
| 7. | Find circular convolution of periodic signals x(n)= {1,2,3,4} and h(n)= {2,2,1,1} |
| Option A | 15,13,12,17 |
| Option B | 17,2,13,5 |
| Option C | 15,13,15,17 |
| Option D | 5,13, 2 ,17 |
| 8. | What is the convolution of a signal with an impulse? |
| Option A | A new signal |
| Option B | Signal multiplied by impulse |
| Option C | Impulse |
| Option D | Signal itself |
| 9. | Which of the following responses of an LTI system does not depend on initial conditions? |

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| Option A | Natural response |
| Option B | free response |
| Option C | forced response |
| Option D | total response |
| 10. | 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 |
| 11. | Which of the following is an energy signal? |
| Option A | x(t)=A ejΩt |
| Option B | x(t)=A sin Ωt |
| Option C | x(t)=B cos Ωt |
| Option D | x(t)=e-at u(t) |
| 12. | Y (t) = x (t/5) is |
| Option A | Amplitude scaled signal by factor 1/5 |
| Option B | Time shifted signal |
| Option C | Expanded signal |
| Option D | Compressed signal |
| 13. | The Fourier transform of a x(t)= e7t u(-t) function is given as: |
| Option A | F (jω) = 1/(7+jω) |
| Option B | F (jω) = 7/(1+jω) |
| Option C | F (jω) = 7/(1-jω) |
| Option D | F (jω) = 1/(7-jω) |
| 14. | In the equation x (t) = be^at if a < 0, then it is called |

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| Option A | Decaying exponential |
| Option B | Both Growing and Decaying exponential |
| Option C | Complex exponential |
| Option D | Growing exponential |
| 15. | Find the Z-transform of δ(n+3). |
| Option A | 1 |
| Option B | z |
| Option C | z2 |
| Option D | z3 |
| 16. | The step function u (t) is integral of with respect to time t. |
| Option A | Exponential function |
| Option B | Impulse function |
| Option C | Ramp function |
| Option D | Sinusoidal function |
| 17. | 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) |
| 18. | 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 |
| 19. | What is the one-sided z-transform of x(n)=δ(n-k)? |

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| Option A | 0 |
| Option B | 1 |
| Option C | z-k |
| Option D | zk |
| 20. | Linear convolution between two sequences x1(n) = {− 1⏟ ,1,2, -2} and  𝗍  x2 (n) = {0.5,1⏟ ,-1,2,0.75} is  𝗍 |
| Option A | {-0.3, − 0. 6⏟ , 3, − 2, − 2. 75, 6. 75, − 2. 5, − 1. 6}  𝗍 |
| Option B | {-0.1, − 0. 5⏟ , 3, − 4, − 2. 75, 9. 75, − 2. 5, − 1. 5}  𝗍 |
| Option C | {-0.5, − 0. 5⏟ , 3, − 2, − 2. 75, 6. 75, − 2. 5, − 1. 5}  𝗍 |
| Option D | {-0.5, − 0. 4⏟ , 1, − 2, − 2. 75, 6. 75, − 2. 5, − 1. 5}  𝗍 |
| 21. | Find the final value, x(∞) in time domain for the s-domain signal X(s)=s/(s2+4). |
| Option A | 0 |
| Option B | 1 |
| Option C | 0.25 |
| Option D | 1.25 |
| 22. | Which of the following systems is stable? |
| Option A | y(t) = exp(x(t)) |
| Option B | y(t) = log(x(t)) |
| Option C | y(t) = tx(t) + 1 |
| Option D | y(t) = sin(x(t)) |
| 23. | The convolution of u(n) with u(n-4) at n=5 is |
| Option A | 5 |
| Option B | 2 |
| Option C | 1 |

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| Option D | 0 |
| 24. | 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 |
| 25. | Determine whether the signal, x(t)=3 cos 2 𝑡 + 7 cos 5 π t is periodic or not |
| Option A | Non-Periodic |
| Option B | Periodic |
| Option C | Rational |
| Option D | Irrational |
| 26. | 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 |
| 27. | Which one of the following systems is causal? |
| Option A | y(t)=x(t)+x(t-3)+x(t2) |
| Option B | y(n)=x(n+2) |
| Option C | y(t)=x(t-1)+x(t-2) |
| Option D | y(n)=x(2n2) |
| 28. | Find the Nyquist rate and Nyquist interval for the signal f(t)=(sin 500πt) / πt. |
| Option A | 500 Hz, 2 sec |
| Option B | 500 Hz, 2 msec |
| Option C | 2 Hz, 500 sec |

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| Option D | 2 Hz, 500 msec |
| 29. | 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) = 1⁄2 (1 – e-2t) u (t) |
| Option B | y(t) = 1⁄2 (1 – e-2t) |
| Option C | y(t) = (1- e-2t) u (t) |
| Option D | y(t) = 1⁄2 (e-2t) u (t) |
| 30. | 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 |
| 31. | Determine the convolution of x1(t)= e -2t u(t) and x2(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) |
| 32. | 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 |
| 33. | Where does the maximum value of auto-correlation function of a power signal occur? |
| Option A | At unity |

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| Option B | At origin |
| Option C | At extremities |
| Option D | At infinity |
| 34. | Determine the Time period of: x(t)=3 cos(20t+5)+sin(8t-3). |
| Option A | 2/5 sec |
| Option B | 1/10 sec |
| Option C | 1/20 sec |
| Option D | 2/4 sec |
| 35. | Which among the following is a LTI system? |
| Option A | y(t)=x(t)cosπt |
| Option B | y(n)=x(n)+nx(n-1) |
| Option C | dy(t)/dt+ty(t)=x(t) |
| Option D | y(n)=x3 (n+1) |
| 36. | ∂(at) = 1⁄a ∂(t), this property of unit impulse is called |
| Option A | Time scaling property |
| Option B | Time shifting property |
| Option C | Time reversal property |
| Option D | Amplitude scaling property |
| 37. | For energy signal Select one |
| Option A | E= ∞ |
| Option B | E=0 |
| Option C | P=0 |
| Option D | P= ∞ |
| 38. | The impulse [response](http://moodle.apsit.org.in/moodle/mod/resource/view.php?id=64997) of a continuous time LTI system is H (t) = e-t u (t-2). The system is |

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| Option A | Neither causal nor stable |
| Option B | Causal but not stable |
| Option C | Stable but not causal |
| Option D | Causal and stable |
| 39. | Find the value of h[n]\*d[n-5], d[n] being the delta function |
| Option A | h[n-4] |
| Option B | h[n-5] |
| Option C | h[n-2] |
| Option D | h[n+5] |
| 40. | Which of the following is not a fourier transform pair? |
| Option A | u(t)↔πδ(ω)+ 1/jw |
| Option B | sgn(t)↔2/jω |
| Option C | A↔2πδ( 𝑤 )  2 |
| Option D | G(t)↔sa( 𝑤τ )  2 |

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| **Q2** | **Questions of 5 marks each** |
| 1 | State and prove any two properties of Fourier Transform. |
| 2 | Determine the following systems are memory less, causal, linear or Time invariant *y(t)=5x(t) +2* |
| 3 | Using Laplace Transform, determine the natural response of the system  represented by the following equations.  (d2y(t)/dt2) + 10 (dy(t)/dt) + 21 y(t) =8 x(t) , y(0)=2, (dy(t)/dt) = -3 at t=0 |
| 4 | Explain in brief the ROC conditions in Laplace Transform. |
| 5 | Determine the autocorrelation of the CT signal given by *x(t)=A rect (t/2).* |
| 6 | 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. |
| 7. | Determine energy and power of signal x(t)= cos5wt |

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| 8. | Test the given system for linearity, causality,stability and time variance  y(t)=x( 2)  𝑡 |
| 9. | Find initial and final value of given Z domain signal |
| 10. | Realize the following FIR system with minimum number of multipliers h(n)={-0.5,0.8,-0.5} |
| 11. | List any 5 properties of Z transform |
| 12. | FInd the response of time invariant system with impulse response h(n)={1,2,1,-1} to an input signal x(n)= {1,2,3,1} |
| 13. | Explain any five types of elementary signals with mathematical equations  and graphical plot. |
| 14. | Find the fundamental period of the signal |
| 15. | Find x(-2t) and x(3t+2) |
| 16. | Find the even and odd part of following signals  1) x(t)= 3+2t+5 2 2)sin2t+cost+sintcos2t  𝑡 |
| 17. | Determine energy and power of unit step signal |
| 19. | Find laplace transform of u(t)-u(t-a) |
| 20. | Find inverse Z transform of  X(z)= 1  −1 −2  1−1.5𝑧 +0.5𝑧 |
| 21. |  |

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| **Q3.** | **Questions of 10 marks each** |
| 1. | Consider a causal LTI system with *H(jω) =(jω+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. |
| 2. | A LTI system has the following transfer function |

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|  | Give all possible ROC condition   1. Show pole-zero diagrams 2. Find impulse response of system 3. Comment on the system stability and causality for all possible ROC’s |
| 3. | Obtain Inverse Laplace Transform of the function *X(s)=(3s+7)/ (s2 -s-12)* for following ROCs, also comment on the stability and causality of the systems for each of the ROC conditions.  Support your answer with appropriate sketches of ROCs.   1. *Rs(s)*>4 2. *Re(s)*<-3 |
| 4. |  |
| 5. | Find the autocorrelation,power and PSD of x(t)= 3 cost +4 cos3t |
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| 10. |  |
| 11. | Find fourier transform of sgn(t) |
| 12. | Find the impulse response h(n) of the system if the spectrum is given by  H( 𝑗𝑤 1  𝑒 )= (1 + 𝑐𝑜𝑠𝑤)  3 |
| 13. | Determine fourier transform of the gate function  x(t)=A for |t|≤ τ  2 |
| 14. | Find initial and final value using laplace transform X(s)= 7𝑠+6  𝑠(3𝑠+5) |
| 15. | Explain relation of ESD, PSD with autocorrelation |
| 16. | Find response of LTI system if impulse response of the system is  h(t)=2 −3𝑡 −5𝑡  𝑒 𝑢(𝑡) for input x(t)=2𝑒 𝑢(𝑡) using fourier transform |
| 17. | Determine fourier transform of |
| 18. | Sketch the following signals for the given signal shown 1) x(-t) 2) x(2t+5) 3)x(2t) 4)x(t/2) 5) -2x(t) |
| 19. |  |

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Time : 2 hours 30 minutes Max. Marks :80

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| Question | Correct Option |
| Q1. | A |
| Q2. | B |
| Q3. | D |
| Q4. | C |
| Q5. | B |
| Q6. | B |
| Q7. | C |
| Q8. | D |
| Q9. | C |
| Q10. | C |
| Q11. | D |
| Q12. | C |
| Q13. | D |
| Q14. | A |
| Q15. | D |
| Q16. | B |
| Q17. | A |
| Q18. | C |
| Q19. | C |
| Q20. | C |
| Q21. | A |
| Q22. | D |

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| Q23. | B |
| Q24. | B |
| Q25. | A |
| Q26. | B |
| Q27. | C |
| Q28. | B |
| Q29. | A |
| Q30. | B |
| Q31. | A |
| Q32. | A |
| Q33. | B |
| Q34. | A |
| Q35. | D |
| Q36. | A |
| Q37. | C |
| Q38. | D |
| Q.39. | B |
| Q.40 | D |