Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
M.Sc. I. Electronic Science

Class : M. Sc. I (Semester- I)
Paper Code: ELE4101 Paper : I
Title of Paper : Mathematical Methods in and Network Analysis

2 Mark Question

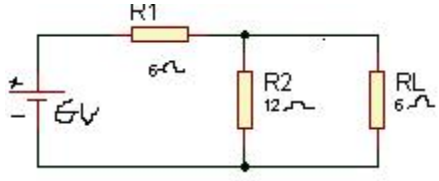
1. Define System.
2. Define Signal.
3. State the relation between step, ramp and delta functions (CT).
4. State the classification of CT signals.
5. Define unit step,ramp and delta functions for CT.
6. Define DT signal. Give few examples of DT signals.
7. Define CT signals. Give few examples for CT signals.
8. Define deterministic and random signals.
9. Define power and energy signals.
10. A discrete signal is given by. x(n) = {1,1,1,1,2} Sketch the following signals:
    i) x(n-2) ii) x(3-n)
11. Compare power and energy signals.
12. Explain the Stability properties of DT-LTI system with suitable example
13. Define periodic and aperiodic signals.
14. State the classification or characteristics of CT and DT systems.
15. Check causality of the system given by, y(n) = x(n-no)
16. Is diode a linear device? Give your reason.
17. Define z-transform and inverse z-transform.
18. What do you mean by ROC?
19. Define Region of convergence.
20. What are left sided sequence and right sided sequence?
21. Define two sided sequence (or) signal.
22. List the properties of region of convergence for the z-transform.
23. List the properties of z-transform.
24. What are the methods used to find inverse z-transform?
25. State the Parseval's theorem of z-transform.
26. Determine the z-transform of unit step sequence.
27. How the stability of a system can be found in z-transform?
28. What is the transfer function of a system whose poles are at -0.3±j0.4 and a zero at -0.2?
29. Define the term homogenous and linear differential equations of order two give examples of each.
30. State bessel differential equation. Give example of occurrence in physics or electronics.
31. What are the different types of differential equations? Classify and give example of each.
32. What is linear differential equation of order two? Give examples.
33. What is mean by homogeneous differential equations? Give examples
34. What are the order and degree of differential equations? Give examples.
35. Explain the term node, tree and branch in connection with electrical network.

36. Explain the term mesh, node and links of network.
37. Define the terms network, Branch, mesh loop

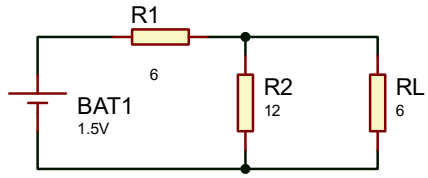
4 Mark Question

1. Sketch the continuous time signal x(t) = 2sinΠt for n interval 0≤ t ≤ 2 sample the continuous time signal with sampling period T=0.2 Sec and sketch the discrete time signal.
2. Explain y(n) = sgn[x(n)] system with respect to following properties
   i) Time invariance ii) Linearity
3. Find the z-transform and ROC of the given sequence x[n]={2,4,-6,3,8,-2}
4. Determine the z-transform of the signal x(n) = α^n u(n) and also the ROC and pole & zero locations of X(z) in the z-plane.
5. State the Parseval's theorem of z-transform.
6. Determine the z-transform of the signal x(n) = -a^nu(-n-1) & plot the ROC.
7. State and prove the time shifting property of z-transform.
8. State initial value theorem of z-transform.
9. Explain in detail about different types operation on signal with suitable examples.
10. Define a system. How the systems are classified?
11. Find Laplace transform of i) t^n ii) cosωt
12. Find the Inverse Laplace transform of f(s) = $(s^2 + s + 1)/s(s+5)(s+3)$
13. Find the Inverse Laplace transform of f(s) = $(s+5)/s(s^2 + 2s + 5)$
14. Verify the final value theorem for the given function f(t) = $6(1-e^{-t})$
15. Find the initial value i(0), value for the given function I(S) $I(S) = \frac{2S+3}{(S+1)(S+3)}$
16. Verify the initial and final value theorem for the function
    $f(t) = e^{-st}(\sin 3t + \cos 5t)$
17. Using laplce transform solve the following differential equation
    d"(i) + 4d'(i) + 8i = 8u(t) Given that i(0+) =3 & d'(0+) = -4
18. State and prove convolution property of z-transform.
19. Using differentiation property obtain the z-transform of unit ramp sequence.
20. The Z- transform of a sequence x(n) is given by X(Z) =$(Z^2 + 2)/(Z^2 - 2z+5)$ find the first 3 terms of sequence
21. Obtain the z transform the following duration sequence and sketch the ROC
    x(n) ={1, 3, 5, 0, 2, 2, 1}
    x(n) ={2, 1, -2, 4, 0,1,}
22. Solve the following differential equation using z-transform
    x(n-2) -9x(n-1) +18x(n) = 0
23. Use residue method to obtain x(n) from: X(Z) = $\frac{z(z+1)}{(z-1)^2}$
24. Find x(n) for the given X(Z) , X(Z) = $\frac{10z}{(z-1)(z-2)}$ using cauchys residue theorem
25. Find the inverse z of X(Z) = $\frac{Z}{Z-1}$ |z| > 1
26. Find the inverse z of X(Z) = $\frac{1-0.5z^{-1}}{1+\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}$ |z| > ½
27. Determine the stability of the following equation
    $Q(S) = S^3 + 6S^2 + 11S + 6$
28. For the given denominator polynomial of network function determine the value of k for which network to stable. $Q(s) = S^3 + 2S^2 + 4S + K$
29. Explain the concept of transfer function. Draw the pole zero plot in s- plane and determine the pole zero of the following system. I(s) = $(2s+5)/ (s^2 + 5s + 6)$
30. An electronics system is modelled using differential equations. Elaborate the statement using appropriate example.

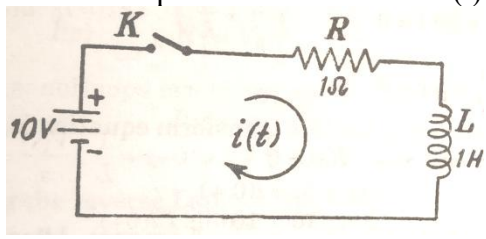
31. Define the term homogeneous and linear differential equation of order two with suitable examples.
32. The coordinates of a point in cartesian coordinate system are (3,4,12). Determine coorrdinates in cylindrical coordinate system.
33. State and explain different types of modeling. Explain any one with suitable example.
34. What is mean by partial differential equation? Give any three examples with partial differential equation in physics.
35. Explain the term ordinary and partial differential equation. Give an example of each
36. State and prove maximum power transfer theorem for AC circuit.
37. State thevenin's theorem for DC resistive network using suitable example.
38. State Norton's theorem for DC resistive network using suitable example.
39. Determine the transfer function of high pass passive RC filter.
40. Draw the block diagram of two port network. Define voltage current transfer admittance & transfer impedance function
41. Draw thevenin's equivalent and find the voltage across R_L in the following circuit.



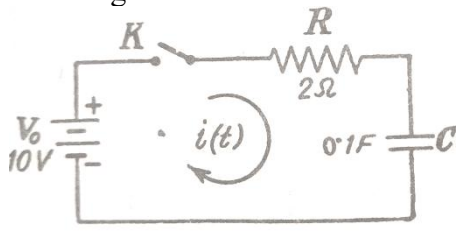
42. Draw thevenin's equivalent and find the voltage across R_L in the following circuit.



43. Determine the inverse Z- transform of $X(Z) = 3/\{z\text{-}1/4\text{-}(1/8)z^{-1}\}$...if x(n) is stable.
44. Determine the z-transform of $x(n) = \cos(\omega_0 n)\, u(n)$
45. In the given circuit switch K is closed at time t=0. There is no current through L prior to switching. Obtain the particular solution for i(t)



46. In the given circuit switch K is closed at time t=0. Obtain the particular solution for current i(t) after the switch is closed. Assume that there is no charge the capacitor C before switching.



6 Marks Questions

1. A discrete signal x(n) is defined as

   X(n) = (1+n/3) for____ $-3 \le n \le -1$

   = 1 for $0 \le n \le 3$

   = 0 elsewhere

   i) Determine its value and sketch the signal x(n)

   ii) Sketch the signal that result if we i) Ist fold x(n) then the delay the resulting sequence by 4 samples ii) Ist delay x(n) by 4 sample then fold the resulting signal

   iii) Express the sequence x(n) in terms of sequence δ(n) and u(n).

2. A discrete signal is given by. x(n) = {1,2,3,4,2} Sketch the following signals:

   i) x(-1-n) ii) x(n+2) iii)Odd samples of x(n) iv) x(n)u(n-1)

   iv) x(n-1) δ(n-1) vi) x(-n)

3. Determine whether the following system is linear or not

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

4. Write a note amplitude and phase spectrum

5. ACheck whether the following system are time variant or not

   i) y(n) = x(n) +nx(n-1) ii) y(n) = x^2(n-1) +a

6. Find the Laplace transform of a saw tooth waveform f(t) which is periodic with period equal to unity i.e. f(t) = at for $0 < t < 1$.

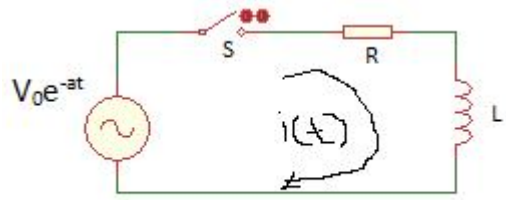
7. State the Initial Value theorem. Using this theorem find the value of I(s) for the Laplace transform I(s) = (2s+3)/ ((s+1)(s+3)

8. State and prove convolution theorem. Determine the Laplace transform of 1/ s^2(s+1)

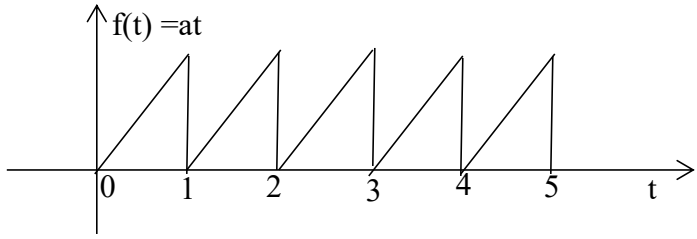
9.

10. In series RLC circuit there is no initial charge on capacitor is switch is closed at t =0, find the resulting current given R=4 Ω, L=1H, C= 0.25f. and input voltage is 8V.

11. Find the current i(t) in the following series RL circuit (at t=0)



12. Find the laplace transform of sawtooth waveform shown in figure



13. Explain the time shifting property of z transform. Using time shifting property find z-transform of $x_2(n)$, if $x_1(n) = \{1, 2, 3, 4, 0, 1\}$ and $x_2(n) = \{1, 2, 3, 4, 0, 1\}$

14. Determine all possible sequences x(n) associated with z-transform

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

15. Determine all possible sequences x(n) associated with z-transform

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

16. Determine inverse Z transform of $X(Z) = \frac{1}{1 - 1.5Z^{-1} + 0.5Z^{-2}}$

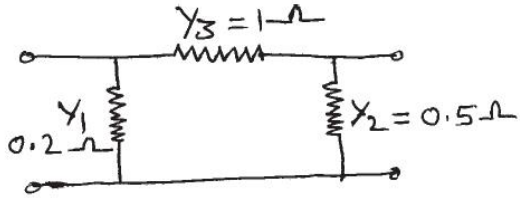
17. Explain the concept of transfer function. Draw the pole zero plot in s- plane and determine the pole zero of the following system. $I(s) = (2s+5)/ (s^2+ 5s+ 6)$

18. Using method of separation of variables separate the variables of laplace equation in sherical coordinate system

19. What is mean by T to π and π to T transform? Convert T network to π for given $R_1=10\Omega$, $R_2=20\ \Omega$, $R_3=40\Omega$

20. What is Z transform? What are the different properties of Z- transform and explain any two.

21. Find the equivalent T- network for the given Π network

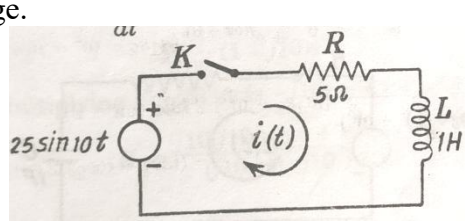


22. Using Laplace transform solve the following differential equation
d"(i) +4d'(i) + 8i = 8u(t) given that i(0) =3 and d'{i(0)} =-4

23. Obtain inverse Z-transform of $X(Z) = \frac{z^2}{0.5-1.5z+z^2}$ for ROC $|z| < 0.5$ using long division method.

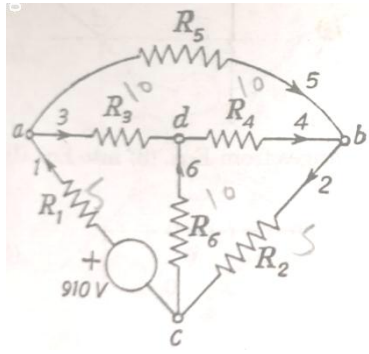
12 Mark Question

1. A sinusoidal voltage 25sin 10t is applied at time t = 0 to serial R-L circuit comprising resistor R = 5Ω and inductor L= 1henery. By the method of laplace transformation find current i(t). Assume zero current through inductor before application of voltage.



2. Explain the basic operations on standard signal. What do you mean by standard signal? Explain the need of standard signal

3. For the given resistive network write tie-set schedule and equilibrium equations on the current basis. Obtain value of branch voltages. Given that $R_1 = 5\Omega, R_2 = 5\Omega$, $R_3 = R_4 = R_6 = 10\Omega$, $R_5 = 2\Omega$.



4. State and prove linear convolution property of Z-transform Find the linear convolution of $x_1(n)$ and $x_2(n)$ using Z-transform $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n)=\{1, 2, 0, 2, 1\}$