Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 1054230

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV / DEC 2024
Fourth Semester
Electrical and Electronics Engineering
U20EC301 – SIGNALS AND SYSTEMS
(Common to Electronics and Communication Engineering)
(Regulation 2020)

Time: Three Hours | Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Check whether the following signal is periodic or not. If periodic, determine the fundamental period x(t)=3cost+4cos(t/2).

2. A given system is characterized by the differential equation; Check the system for linearity and stability
$$\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$$

3. Using the properties, Determine the Fourier transform of $x(t) = t\ e^{-at}u(t)$.

4. Write about even and odd symmetry of Fourier series.

5. Define ROC**.** Illustrate the Z-transform pair.

6. Find the Z-transform of $x(n) = na^n u(n)$.

7. State the advantages of Direct form II over Direct form I.

8. The ROC of Z-transform of the discrete time sequence
x(n)= $\left(\frac{1}{3}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(-n-1)$ is

9. Derive the L.T. of the signal u(t)* u(t-1) using the convolution property.

10. State the initial and final value theorem of the Laplace transform.

PART – B (5 x 16 = 80 Marks)

11. (a) Find whether the following signals are periodic, if periodic find the fundamental period
(i) x[t] = sin 2t (ii) x(t) = e^{-3t} (iii) 4cos5πt (v) x(n) =sin2πn+sin6πn (16)

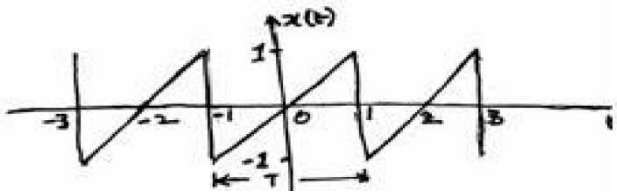
(OR)

(b) Check whether the following systems are static/dynamic, causal/non- causal, linear/non-linear, time-variant/time-invariant
(i) y (n) = n x(n) (ii) y(t) = $e^{x(t)}$ (iii) y[t] = cos x(t) (iv) y(n) = 2x(2n) (16)

12. (a) Obtain the trigonometric Fourier series for the half wave rectified Sine function of 't'. (16)

(OR)

(b) Find the trigonometric Fourier series for the periodic signal x(t) shown in figure. (16)



13. (a) State and prove any FIVE properties of z-transform. (16)

(OR)

(b) Find the inverse Z-transform of
$X(Z) = \frac{1}{1-az^{-1}}$; where the ROC |z| < |a| (16)

14. (a) Consider a continuous-time LTI system described by $\frac{dy(t)}{dt} + 2y(t) = x(t)$ using the Fourier transform, find the output Response y(t) to each of the following input signals:
(i) $x(t) = \delta(t)$ (ii) $x(t) = e^{-t}u(t)$ (16)

(OR)

(b) Consider an LTI system with impulse response

$$h[n] = \begin{cases} a^n & n \geq 0 \\ 0 & n < 0 \end{cases}$$ and input $$x[n] = \begin{cases} 1 & 0 \leq n \leq N-1 \\ 0 & otherwise \end{cases}$$

Determine the output y[n] by explicitly evaluating the discrete convolution of x[n] and h[n]. (16)

15. (a) Consider the RLC circuits shown in figure a and b.

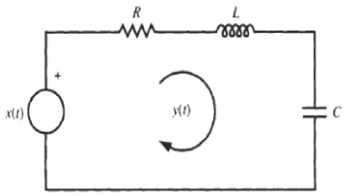


Fig. a

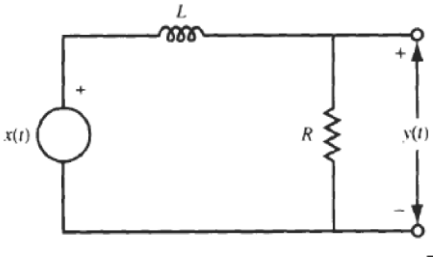


Fig. b

(i) Find the differential equation relating the output voltage y(t) and the input voltage x(t).
(ii) Find the impulse response h1(t) and h2(t) of the circuits.
Analyze the performance of both circuits by comparing their stability and linearity conditions. (16)

(OR)

(b) Obtain the convolution of the given two signals using the convolution property of the Laplace transform and evaluate the results also with the conventional method of convolution.
$x(t) = e^{-3t}\,u(t)$ and $y(t) = e^{-2t}\,u(t)$ (16)

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