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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code : **20EET305**

Course Name: **Signals and Systems**

Max. Marks : **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Solve the following discrete time systems.
   (a) $\sum_{n=-\infty}^{\infty} e^{2n}\delta(n-2)$
   (b) $\sum_{k=0}^{n} a^{k-2}\delta(k+3)$
2. Explain when a continuous system is said to LTI system and explain with suitable diagram.
3. Explain the significance of Dirichlet conditions in continuous time Fourier series.
4. Find the Laplace transform of the signal $[4e^{-2t}\cos 5t - 3e^{-2t}\sin 5t]\ u(t)$ and its ROC.
5. Explain Maison's gain formula with suitable example.
6. Explain Routh Hurwitz stability criterion.
7. State sampling theorem and explain anti-aliasing filter.
8. Find the z-transform and ROC for the signal $x(n)=a^n u(n)$.
9. State the relationship between DTFT and Z transform.
10. State and explain any one property of discrete time Fourier transform.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Check whether the following systems are causal or not (6)
    (i) $y(t) = x(t/2)$
    (ii) $y(n)=\sum_{k=-\infty}^{n+1} x(k)$

    b) Check whether the following system is linear or not (4)
    (i) $\frac{dy(t)}{dt} + t^2 y(t) = 2x(t)$
    (ii) $y(n)=2x(n)+\frac{1}{X(n-1)}$

    c) Check whether the following system is (i) static or dynamic (ii) time variant or invariant (4)

$$\frac{d^2y(t)}{dt^2} + \frac{3tdy(t)}{dt} + y(t) = x(t)$$

OR

12. a) Discuss the condition on impulse response for causality and impulse response. (2)

b) From the given impulse responses h(n) of the systems, find whether the systems are causal and stable. (12)

(i) $2^n u(-n)$

(ii) $e^{2n}u(n-1)$

(iii) $5^n u(3-n)$

(iv) $e^{-6|n|}$

MODULE II

13. a) Find the Fourier transform of the following and sketch the magnitude and phase spectrum (10)

(i) $x(t)=e^{-at}u(t)$

(ii) $x(t)=e^{-|t|}$

b) Find the inverse of the Fourier Transform (4)

(i) $\delta(\Omega)$

(ii) $\delta(\Omega - \Omega_0)$

OR

14. a) Discuss any four properties of the Laplace Transform. (8)

b) Find (6)

(i) Laplace transform of $x(t)=e^{-2t}\sin 2tu(t)$.

(ii) Inverse Laplace transform of $x(s)=\frac{1}{s(s+2)}$.

MODULE III

15. a) Construct the block diagram and signal flow graph of the following system whose input and output relations are given below. (10)

$$x_1 = 4x_1 + 7x_2 + 11x_3 + 2u_1$$
$$x_2 = 6x_1 + 8x_2 + 14x_3 + 20u_2$$
$$x_3 = x_1 + 12x_2 + 3x_3$$

Where u_1 and u_2 are the input variables and x_1, x_2 and x_3 are the output variables.

b) Find the unit step response of $\frac{C(s)}{R(S)} = \frac{4}{(S+2)(S+4)}$. (4)

OR

16. a) What do you mean by positive real function and when can a function become positive real function. (5)

b) Check the given function is positive real or not. (4)

$$H(s) = \frac{(s-2)}{(s+2)(s-3)}$$

c) Check the stability of the given polynomial using Routh Hurwitz. (5)

$$s^5 + s^4 + 4s^3 + 2s^2 + s + 5 = 0$$

MODULE IV

17. a) Explain about any four properties of z-transform (7)

b) Find the inverse z transform for the following function. (7)

$$x(z)=\frac{z(z-1)}{(z+2)^3(z+1)}$$

OR

18. a) Explain about

(i) Zero hold circuit and derive its transfer function.

(ii) Nyquist Rate

(iii) A signal x(t)=sinc(150Πt) is sampled a rate of (a) 100 Hz (b) 200Hz for each these two cases explain if you can recover the signal x(t) from the sampled signal. (10)

b) Find the z-transform of the signal x(n)=(sinω_0n) u(n) and find ROC and pole zero location. (4)

MODULE V

19. a) Realize the system given by difference equation by direct form I, II cascade and parallel form (10)

$$y(n) = -0.1y(n-1) + 0.72y(n-1) + 0.7x(n) - 0.252x(n-2)$$

b) State and prove any two properties of Discrete Fourier series (4)

OR

20. a) State and prove any two properties of discrete Time Fourier Transform (4)

b) (i) Write short notes on bilinear transformation for stability analysis.

(ii) Find the stability of the given system using Jury's test. (10)

$$P(z) = z^4 - 1.2z^3 + 0.07z^2 + 0.3z + 0.08$$

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