Reg. No. :

# Question Paper Code : X 60442

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Third Semester
Electronics and Communication Engineering
EC 2204/EC 35/EC 1202 A/10144 EC 305/080290015 – SIGNALS AND SYSTEMS
(Common to Biomedical Engineering)
(Regulations 2008/2010)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Determine whether the following signal is energy or power signal. And calculate its energy or power : $x(t) = e^{-2t} u(t)$.

2. Check whether the following system is static or dynamic and also causal or non-causal : $y(n) = x(2n)$.

3. State Dirichlet's conditions.

4. Give the equation for trigonometric Fourier series.

5. Determine the Laplace transform of the signal $\delta(t - 5)$ and $u(t - 5)$.

6. Determine the convolution of the signals $x[n] = \{2, -1, 3, 2\}$ and $h[n] = \{1, -1, 1, 1\}$.

7. What is the z transform of $\delta(n + k)$ ?

8. What is aliasing ?

9. Write the $n^{th}$ order difference equation.

10. Write the state variable equations of a DT-LTI system.

PART – B **(5×16=80 Marks)**

11. a) Determine whether the systems described by the following input-output equations are linear, dynamic, casual and time variant : **(4×4=16)**

i) $y_1(t) = x(t - 3) + (3 - t)$

ii) $y_2(t) = dx(t)/dt$

iii) $y_1[n] = n\, x[n] + bx^2[n]$

iv) Even $\{x[n - 1]\}$.

(OR)

b) A discrete time system is given as $y(n) = y^2(n - 1) = x(n)$. A bounded input of $x(n) = 2\delta(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether system is stable or unstable.

12. a) i) Find the Fourier transform of $x(t) = \sum_{n=-\infty}^{\infty} x(t - nT)$. **(6)**

ii) Prove the time scaling property of Fourier transform and hence find the Fourier transform of $x(t) = e^{-0.5t}\, u(t)$. **(6)**

iii) Derive the relation between trigonometric Fourier series and exponential Fourier series. **(4)**

(OR)

b) i) Find the Laplace transform of $[4e^{-2t} \cos 5t - 3e^{-2t} \sin 5t]u(t)$. **(8)**

ii) Find the inverse Laplace transform of $X(S) = \frac{1 + e^{-2s}}{3s^2 + 2s}$. **(8)**

13. a) i) Define convolution integral and derive its equation. **(8)**

ii) A stable LTI system is characterized by the differential equation.

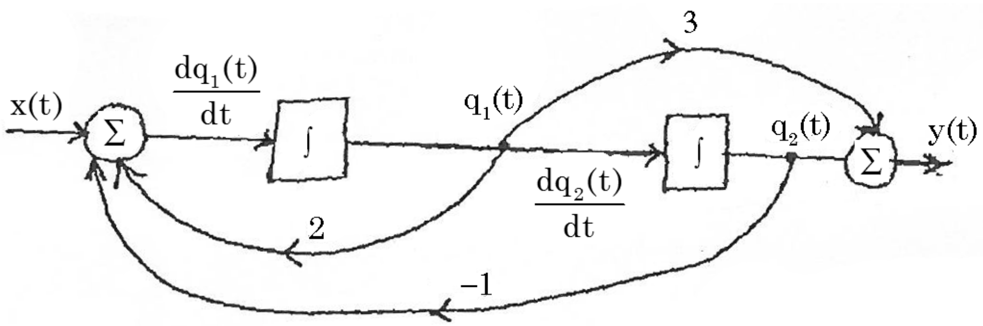
$$\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t) \cdot$$

Find the frequency response and impulse response using Fourier transform. **(8)**

(OR)

b) i) Draw direct form, cascade form and parallel form of a system with system function $H(s) = \frac{1}{(s+1)(s+2)}$. **(8)**

ii) Determine the state variable description corresponding to the block diagram given below. **(8)**




14. a) i) State and prove sampling theorem for low pass band limited signal and explain the process of reconstruction of the signal from its samples. **(10)**

ii) State and prove any two properties of DTFT. **(6)**

(OR)

b) i) Find the z-transform of the sequence $x(n) = \cos(n\theta)\, u(n)$. **(8)**

ii) Determine the inverse z-transform of the following expression using partial fraction expansion : **(8)**

$$X(z) = \frac{1}{\left(1-\frac{1}{3}z^{-1}\right)\left(1-\frac{1}{6}z^{-1}\right)}, \text{ ROC} : |z| > \frac{1}{3}.$$

15. a) i) Obtain the impulse response of the system given by the difference equation

$$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n).$$ **(10)**

ii) Determine the range of values of the parameter "a" for which the LTI system with impulse response $h(n) = a^n u(n)$ is stable. **(6)**

(OR)

b) Compute the response of the system :

$y(n) = 0.7y(n-1) - 0.12y(n-2) + x(n-1) + x(n-2)$ to the input $x(n) = nu(n)$. Is the System stable ? **(16)**

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