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Question Paper Code : 57282

B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Third Semester

Electronics and Communication Engineering

EC 6303 – SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A ($10 \times 2 = 20$ Marks)

1. Sketch the following signals :

   $\text{rect}\left(\frac{t+1}{4}\right)$; 5 ramp (0.1t)

2. Given $g(n) = 2e^{-2n-3}$. Write out and simplify the functions

   (i) $g(2-n)$ (ii) $g\left(\frac{n}{10}+4\right)$

3. What is the inverse Fourier transform of

   (i) $e^{-j2\pi f t_0}$ (ii) $\delta(f - f_0)$

4. Give the Laplace Transform of $x(t) = 3e^{-2t}\,u(t) - 2e^{-t}\,u(t)$ with ROC.

5. Find whether the following system whose impulse response is given is causal and stable $h(t) = e^{-2t}\,u(t-1)$.

6. Realize the block diagram representing the system $H(s) = \frac{s}{s+1}$.

7. Write the conditions for existence of DTFT.

8. Find the final value of the given signal

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

9. From discrete convolution sum, find the step response in terms of h(n).

10. Define the non recursive system.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Find whether the following signals are periodic or aperiodic. If periodic find the fundamental period and fundamental frequency (8)

$$x_1(n) = \sin 2\pi t + \cos \pi t$$

$$x_2(n) = \sin \frac{n\pi}{3} \cdot \cos \frac{n\pi}{5}$$

(ii) Find whether the following signals are power or energy signals. Determine power and energy of the signals. (8)

$$g(t) = 5 \cos\left(17\pi t + \frac{\pi}{4}\right) + 2 \sin\left(19\pi t + \frac{\pi}{3}\right)$$

$$g(n) = (0.5)^n u(n)$$

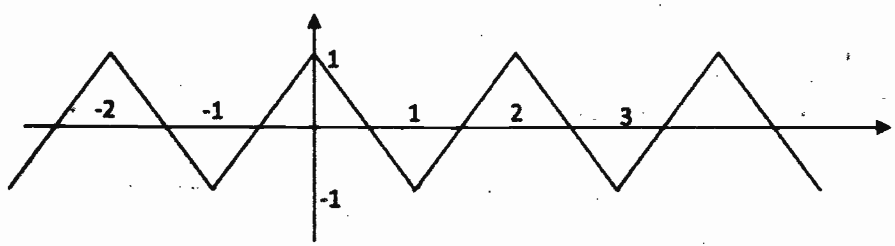
OR

(b) Find whether the following systems are time variant or fixed. Also find whether the systems are linear or nonlinear

$$\frac{d^3y(t)}{dt^3} + 4\frac{d^2y(t)}{dt^2} + 5\frac{dy}{dt} + y^2 t = x(t)$$ (8)

$$y(n) = an^2 \times (n) + bn \times (n-2)$$ (8)

12. (a) Obtain the Fourier series coefficients & Plot the spectrum for the given waveform (16)



OR

(b) (i) From basic formula, determine the Fourier transform of the given signals. Obtain the magnitude and phase spectra of the given signals. (5 + 5)

$te^{-at}u(t), \quad a > 0$

$e^{-a|t|} \quad , \quad a > 0$

(ii) State and prove Rayleigh's energy theorem. (6)

13. (a) (i) Using graphical convolution, find the response of the system whose impulse response is (8)

$$h(t) = e^{-2t}u(t)$$

for an input $x(t) = \begin{cases} A, & \text{for } 0 \le t \le 2 \\ 0, & \text{otherwise} \end{cases}$

(ii) Realize the following is indirect form II. (8)

$$\frac{d^3y(t)}{dt^3} + 4\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 8y(t) = 5\frac{d^2x(t)}{dt^2} + 4\frac{dx(t)}{dt} + 7x(t)$$

OR

(b) (i) An LTI system is defined by the differential equation (10)

$$\frac{d^2y(t)}{dt^2} - 4\frac{dy(t)}{dt} + 5y(t) = 5 \times (t)$$

Find the response of the system y(t) for an input $x(t) = u(t)$, if the initial conditions are $y(0) = 1; \frac{dy(t)}{dt}\Big|_{t=0} = 2$.

(ii) Determine frequency response and impulse response for the system described by the following differential equation. Assume zero initial conditions. (6)

$$\frac{dy(t)}{dt} + 3y(t) = x(t)$$

14. (a) (i) State and prove sampling theorem. (10)

(ii) What is aliasing ? Explain the steps to be taken to avoid aliasing. (6)

OR

(b) State and prove the following theorems :

(i) Convolution theorem of DTFT (8)

(ii) Initial value theorem of z-transform (8)

15. (a) (i) Realise the following system in cascade form **(10)**

$$H(z) = \frac{1 + \frac{1}{5} z^{-1}}{\left(1 - \frac{1}{2} z^{-1} + \frac{1}{3} z^{-2}\right)\left(1 + \frac{1}{4} z^{-1}\right)}$$

(ii) Convolve $x(n) = \{1, 1, 0, 1, 1\}$ **(6)**

$$\uparrow$$

$$h(n) = \{1, -2, -3, 4\}$$

$$\uparrow$$

OR

(b) A system is governed by a linear constant coefficient difference equation

$$y(n) = 0.7\, y(n-1) - 0.1\, y(n-2) + 2x(n) - x(n-2)$$

Find the output response of the system y(n) for an input $x(n) = u(n)$ **(16)**
