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

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 × 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)**

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

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

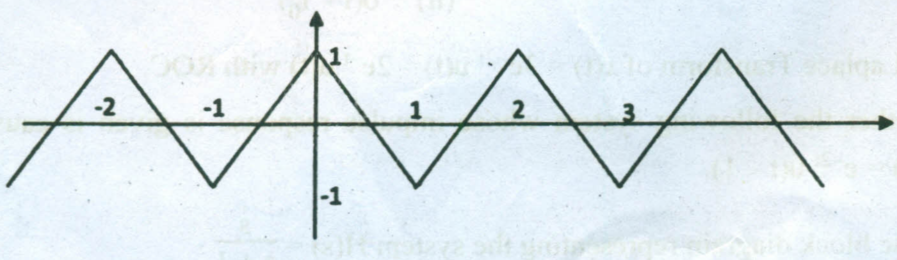
OR

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

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

$$y(n) = an^2 \times (n) + bn \times (n-2) \qquad \textbf{(8)}$$

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)**

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

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

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

(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)