Reg. No. :

Question Paper Code : 20409

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering/Medical Electronics)

(Regulations 2013)

(Also Common to PTEC 6303 – Signals and Systems for B.E. (Part-Time) Second Semester Electronics and Communication Engineering Regulations –2014)

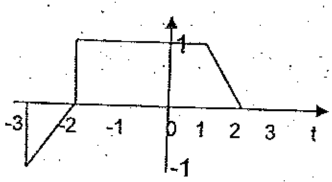
Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compute the average power and energy of the signal $x(t)=r(t)-r(t-2)$, where $x(t)=\begin{cases} t; t \le 2 \\ 2; t > 2 \end{cases}$.

2. Plot $x(3-5t)$ for the signal $x(t)$. (Give the sequence of transformation).

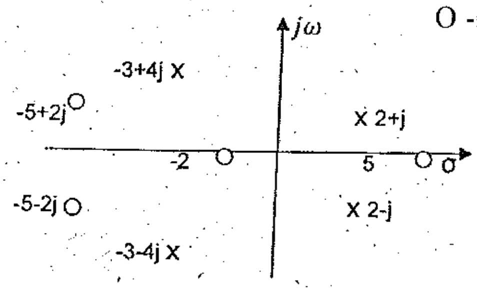


3. Consider a periodic signal $x(t)$ with fundamental frequency 2π and $a_0=1$, $a_1=a_{-1}=1/4$, $a_2=a_{-2}=1/2$, $a_3=a_{-3}=1/3$. Express $x(t)$ in general Fourier series formula.

4. State Dirichlet's condition of Fourier transform.

5. The impulse response $h[n]$ is given below. Check the system is stable/causal.
$h[n]=\left[\frac{1}{3}\right]^n u[n]$.

6. The pole zero plot of the transfer function H(s) of a LTI system is given below.



Plot the ROC for the following cases when:

(a) The system is causal

(b) The system is stable.

7. Find the Z-transform of the signal. $x[n]=\cos(n\omega T)\,u[n]$.

8. Find DTFT of the signal $x[n]=\left[\frac{1}{3}\right]^n u(n)$.

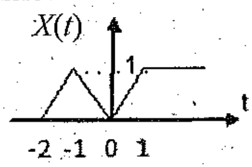
9. Find $x(\infty)$ if $X(z)$ is given by $\frac{z+1}{3(z-1)(z+0.9)}$.

10. Consider the second order system function $H(z)=\frac{1}{\left(1+\frac{1}{2}Z^{-1}\right)\left(1-\frac{1}{4}Z^{-1}\right)}$ implement the system in parallel form.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw the waveform for the signal $x(t)=u(t)+r(t)-2r(t-1)+r(t-2)-u(t-2)$, where $u(t)$ and $r(t)$ are unit step and ramp respectively. (3)

(ii) Determine and sketch the even and odd part of the signal. (3)



(iii) A continuous time system is given by $y(t)=\int_{-\infty}^{2t} x(t)\,dt$. Check whether the system is Linear / Time variant'/ Causal/ Static. (7)

Or

(b) (i) A continuous time system is given by, $y(t)=\begin{cases}0 & ; x(t)\geq 0\\ x(t)+x(t-2); & x(t)<0\end{cases}$

Check whether the system is Linear / Time variant/ Causal/Static. (7)

(ii) Draw the waveform for the signal $x(t)=r(t)-2r(t-1)+r(t-2)$. (3)

(iii) Find whether the signal is periodic or not. (3)

$$x[n]=e^{j\left[\frac{2\pi}{3}\right]^n}+e^{j\left[\frac{3\pi}{4}\right]n}.$$

12. (a) (i) Find Fourier transform of the signal $x(t)=\begin{cases}1 ; |t|<T_1\\ 0 ; |t|>T_1\end{cases}$. (5)

(ii) Find the Laplace transform of the signal $x(t)=e^{-2t}u(t)+e^{-t}(\cos 3t)$ $u(t)$. (8)

Or

(b) (i) Using properties of Fourier transform find $X(j\omega)$ and $G(j\omega)$.

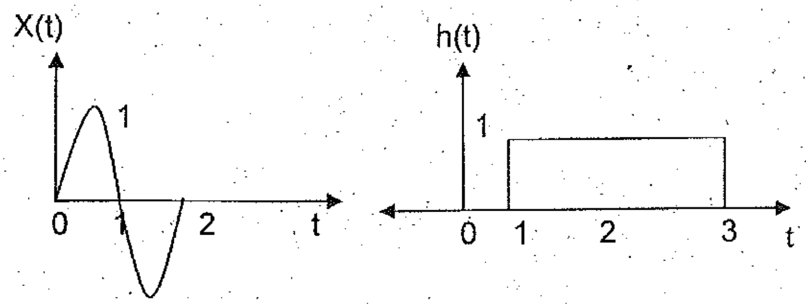
(1) $x(t)=e^{-a|t|}\ u(t); a>0$ (3)

(2) $g(t)=2/(1+t^2)$. (3)

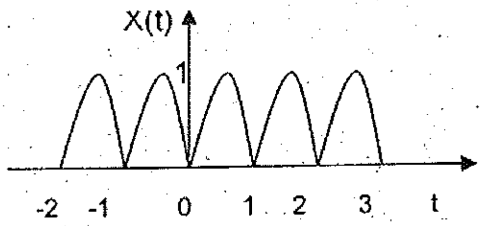
(ii) Find the Inverse Laplace transform of $X(s)$ (7)

$$X(s)=\frac{3s^2+8s+6}{(s+2)(s^2+2s+1)}.$$

13. (a) (i) Find the convolution for the given signals. (7)

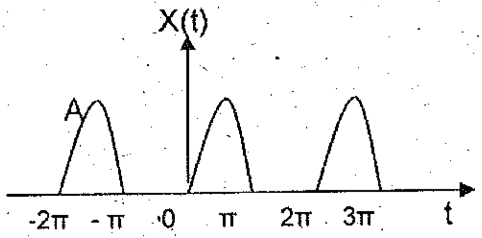


(ii) Determine the exponential Fourier series representation for the full wave rectified sine wave shown in the figure and also plot the line spectrum. (6)



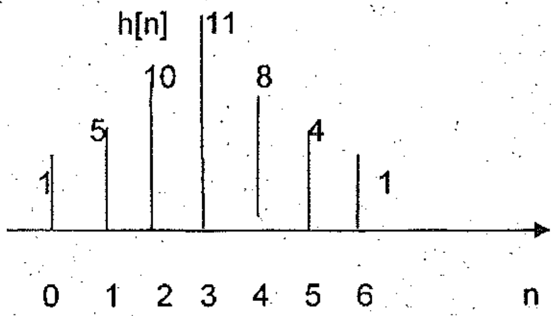
Or

(b) (i) Find cosine Fourier series of half wave rectified sine function. (8)



(ii) Find the convolution between $x[n]$ and $h[n]$, where $x[n] = \alpha^n u[n]$; $0 < \alpha < 1$ and $h[n] = u[n]$. (5)

14. (a) (i) Consider the cascade interconnection of 3 causal LTI system. The impulse response $h_2[n] = u[n] - u[n-2]$. The overall response is given below. $X[n] \to h_1[n] \to h_2[n] \to h_2[n] \to y[n]$.



Find the

(1) impulse response $h_1[n]$ (4)

(2) The response of the overall system to the input $x[n] = \delta[n] - \delta[n-1]$. (4)

(ii) Let $h(t)$ be a triangular pulse and let $x(t)$ be the impulse train. Determine and sketch $y(t)$ for the following value of T.

(1) $T = 4$

(2) $T = 2$

(3) $T = 1$

(4) $T = 3/2$. (5)

Or

(b) (i) Using partial fraction method, find the inverse of Z-transform

$$X(z) = \frac{z^2}{(1-az)(z-a)}; Roc : a < |z| < \frac{1}{a}.$$ (7)

(ii) Find the discrete time Fourier transform $x(n) = (0.5)^n\ u(n) + 2^n u(-n-1)$. (3)

(iii) Find the frequency response of the causal system: (3)

$$y[n] - \left(\frac{1}{4}\right)y(n-1) - \left(\frac{3}{8}\right)y(n-2) = x(n) + x(n-1).$$

15. (a) (i) Consider a continuous time LTI system,

$$\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t).$$

(1) Find the system function $H(s)$. (3)

(2) Determine the impulse response $h(t)$ for (3)

(A) the system is causal

(B) system is stable

(C) system is neither causal or stable.

(ii) Realize the given system in direct form II

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

Or

(b) (i) Consider the system $H(z)=\frac{0.2z}{(z+0.4)(z-0.2)}; ROC; |z|>0.4$. (8)

(1) Find the impulse response function of the system

(2) Is DTFT exists for the system? if so, how?

(3) Find the DTFT.

(ii) Obtain the cascade form realization of the system described by the difference equation.

$$y(n)-\frac{1}{4}y(n-1)-\frac{1}{8}y(n-2)=x(n)+3x(n-1)+2x(n-2).$$ (5)

PART C — (1 × 15 = 15 marks)

16. (a) State and prove the properties of discrete Fourier transform. (15)

Or

(b) Explain the following :

(i) Deterministic and random signals. (8)

(ii) Base band sampling. (7)