Total No. of Questions – [08] Total No. of Printed Pages 02

G.R. No.	

U218-133(ESE)

DECEMBER 2018/ENDSEM
S. Y. B. TECH. (E&TC) (SEMESTER - I)

COURSE NAME: Signals & Systems **COURSE CODE: ETUA21173**

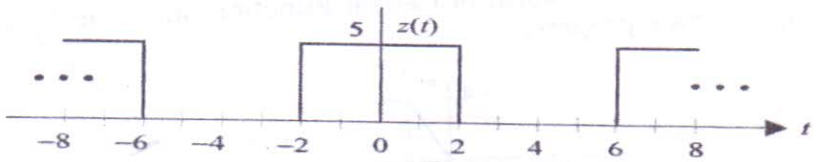
(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q. 1 a) Classify the continuous time signal shown in figure below as energy or power signal. [6]



OR

b) Express the CT signal [6]

$$x(t) = \begin{cases} t, & 0 \le t < 1 \\ 0, & elsewhere \end{cases}$$

as a combination of even and odd signal

Q. 2 a) The system with excitation x(t), and response y(t), described by: [6]

$$y(t) = x\left(\frac{t}{2}\right)$$

Determine whether it is causal, Linear, Time Invariant, Stable?

OR

b) The system with excitation x(t), and response y(t), described by: [6]

$$y(t) = \cos(2\pi t)\, x(t)$$

Determine whether it is causal, Linear, Time Invariant, Stable?

Q. 3 a) The input signal $x(t) = e^{-t}\, u(t)$ applied to the system which has impulse response is given by [6]

$$h(t) = \begin{cases} 1 - t & 0 \le t < 1 \\ 0, & elsewhere \end{cases}$$

Calculate the output of the system.

OR

b) Determine the step response of the systems with the following impulse responses: [6]

(i) $h(t) = \delta(t) - \delta(t-2)$,

(ii) $h(t) = 2\,\mathrm{rect}(t/2)$,

Q. 4 a) Determine the signal x(t) whose frequency shifted impulse function: [4]

$$X(\omega) = \delta(\omega - \omega_0).$$

OR

b) The input signal $x(t)=e^{-t}\,u(t)$ and impulse response $h(t)=e^{-2t}\,u(t)$ produces the output $y(t)= (e^{-t}-e^{-2t})\,u(t)$, Verify the above result using CTFT- based approach. [4]

Q. 5 a) Following differential equation is used to describe RLC circuit [6]

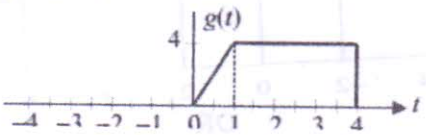
$$\frac{d^2w}{dt^2} + 7\frac{dw}{dt} + 12w(t) = 12x(t)$$

Determine overall response of the system produced by the input $x(t)= 2e^{-t}u(t)$ given initial conditions $w'(0^-)=5v$ and $w(0^-)=0$

b) Calculate the impulse response right-sided signal with transfer function [4]

$$G(s) = \frac{7s - 6}{(s^2 - s - 6)}$$

c) Calculate Laplace Transform of Causal Function shown in figure using appropriate property. [4]



OR

Q. 6 a) Given Laplace Transform pair [6]

$$\cos(w_0 t)\,u(t) \leftrightarrow \frac{s}{(s^2 + w_0{}^2)} \; with\; ROC: Re\{s\} > 0$$

Derive unilateral Laplace transform of $\sin(w_0 t)\,u(t)$ using integration property.

b) Find unilateral Laplace transform of $x(t) = t^2\, e^{-2t}\, u(t)$ using appropriate property. [4]

c) Calculate initial and final values of the function $x_1(t)$ whose Laplace transform are specified below. [4]

$$X_1(s) = \frac{s}{(s^2 + w_0{}^2)} \; with\; ROC: Re\{s\} > 0$$

Q. 7 a) Define autocorrelation of energy signal. State and prove its properties. [6]

b) Find autocorrelation of the following signal [4]
x[n] = { 2, -3, 1, -2}

c) What is correlogram. Explain with suitable example [4]

OR

Q. 8 a) Find cross correlation of following signal. [6]
x[n] = { 2 3 4 5} and y[n] = {3 2 1 4} using graphical method

b) Find ESD of the following signal $x(t)= e^{-100t}\,u(t)$ [4]

c) State properties of PSD for autocorrelation. [4]