

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2020

Subject Code:3141005

Date:11/02/2021

Subject Name:Signal & Systems

Time:02:30 PM TO 04:30 PM

Total Marks:56

Instructions:

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

- Q.1** (a) Find even and odd parts of $x(t) = u(t)$. **03**
 (b) Check whether the following system is dynamic, causal, time invariant, stable: $y[n] = \frac{1}{3}\{x[n] + x[n-1] + x[n-2]\}$ **04**
 (c) Classify signals. Give examples of each. **07**
- Q.2** (a) Sketch the following waveform: $x(t) = u(t+1) - 2u(t) - 2u(t-1)$. **03**
 (b) Define energy and power. Hence, define energy signal and power signal. **04**
 (c) Evaluate continuous time (CT) convolution integral given as: **07**

$$y(t) = e^{-2t}u(t) * u(t+2)$$
- Q.3** (a) List out properties of convolution. **03**
 (b) Find the step response of the system whose impulse response is given as: **04**
 $h(t) = u(t+1) - u(t-1)$
 (c) Find the exponential Fourier series of Half wave rectifies sine wave shown in figure:1. **07**

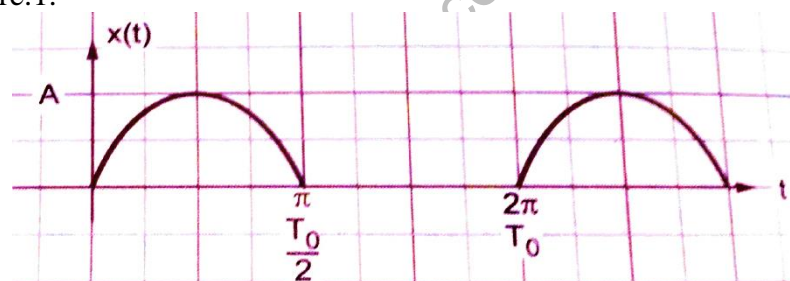


Figure:1

- Q.4** (a) Find the output of an LTI system with impulse response $h(t) = \delta(t-3)$ for the input $x(t) = \cos 4t + \cos 7t$ **03**
 (b) Calculate the convolution of $x[n]$ and $h[n]$: **04**
 $x[n] = \{1, 1, 0, 1, 1\}$ $h[n] = \{1, -2, -3, 4\}$
 (c) Obtain the Fourier Transform of following signals: **07**
 1. $x(t) = \cos \omega_0 t$ 2. $x(t) = \sin \omega_c t u(t)$
- Q.5** (a) State and prove frequency shifting property of Fourier Transform. **03**
 (b) Find the Fourier Transform of $x[n] = -a^n u[-n-1]$, where a is real. **04**
 (c) Compute DFT of the following sequence $x[n] = \{0, 1, 2, 3\}$ **07**
- Q.6** (a) State and prove time scaling property of Fourier Transform. **03**
 (b) Bring out difference between DFT and Fourier Transform (FT). **04**

- (c) Calculate the DFT of a sequence $x[n] = \{1, 1, 0, 0\}$ and check the validity of DFT by calculating its IDFT. 07
- Q.7** (a) Prove time shifting property of z- transform. 03
 (b) What is ROC with respect to z- transform? What are its properties? 04
 (c) Determine inverse z- transform of 07

$$X(z) = \frac{1}{(1 + z^{-1})(1 - z^{-1})^2}, \text{ ROC : } |z| > 1$$

- Q.8** (a) Prove differentiation in z-domain property of z- transform. 03
 (b) Find the z- transform and ROC of the following sequence: 04

$$x[n] = \frac{1}{2} \delta[n + 1] + 5 \left(\frac{1}{2}\right)^{-n} u[n] + 4^n u[-n - 1]$$

- (c) Determine the sequence $x[n]$ from following function: 07

$$X(z) = \frac{1+z^{-1}}{1-z^{-1}+0.5z^{-2}} \text{ Assume that } x[n] \text{ is causal.}$$

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