

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**B.Tech. Summer 2018 - 19 Examination**

**Semester: 5**  
**Subject Code: 03107306**  
**Subject Name: Signals Systems and Transformation**

**Date: 21/05/2019**  
**Time: 10.30 am to 1.00 pm**  
**Total Marks: 60**

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1 Objective Type Questions - (All are compulsory) (Each of one mark) (15)**

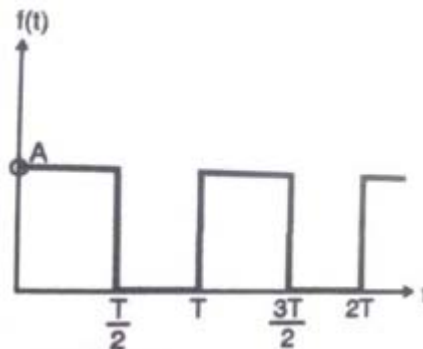
1. Fourier transform of discrete time, aperiodic signal will be \_\_\_\_\_.  
 [a] Discrete frequency, aperiodic in frequency [b] Discrete frequency, periodic in frequency  
 [c] Continuous frequency, aperiodic in frequency [d] Continuous frequency, periodic in frequency
2. A linear time invariant system is characterized by the system function  $H(z) = 1 / (1 - 0.5z^{-1}) + 2 / (1 - 3z^{-1})$ . What is the ROC of  $H(z)$  if the system is causal?  
 [a]  $|z| < 3$  [b]  $|z| > 3$   
 [c]  $|z| < 0.5$  [d]  $|z| > 0.5$
3. Time scaling operation is also known as \_\_\_\_\_.  
 [a] Down-sampling [b] Up-sampling  
 [c] Sampling [d] None of the mentioned
4. A CT-LTI system is causal if its impulse response is \_\_\_\_\_
5. Which operation in frequency domain is equal to multiplication in time domain?
6. What is invertibility system?
7. If convolution is performed between two signals,  $x$  and  $h$ , with lengths  $N_x$  and  $N_h$ , then what will be the length  $N$  of resulting signal?
8. Define Continuous Time (C.T) & Discrete Time (D.T) signals.
9. Integration of unit impulse function over  $(-\infty, \infty)$  yields \_\_\_\_\_ signal and differentiating a unit ramp function yields \_\_\_\_\_ signal.
10. All energy signal has \_\_\_\_\_ average power, whereas a power signal has \_\_\_\_\_ energy.
11. Find even and odd components of signal  $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$ .
12. Find inverse Laplace transform of  $\frac{1}{s} (1 - e^{-2s})$ .
13. Determine z-transform and its ROC of  $x(n) = u(n)$ .
14. Determine whether following signal is periodic or not. If it is periodic, find fundamental period.  
 $x(n) = (-1)^n$ .
15. Sketch the waveform of the following signal.  $x(t) = u(t + 1) - 2u(t) + u(t - 1)$ .

**Q.2 Answer the following questions. (Attempt any three) (15)**

- A) Find the step response of the system whose impulse response is given as  $h(t) = u(t + 1) - u(t - 1)$ .
- B) State and prove Differentiation property of Z-transform.
- C) Explain Sampling Theory and discuss about eliminate aliasing, Nyquist Rate and Nyquist interval.
- D) Write the properties of convolution and explain them with suitable example.

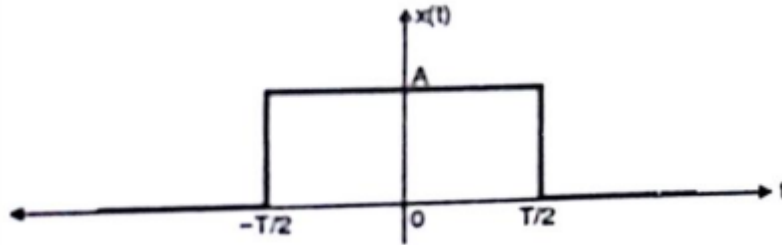
**Q.3 A) Derive necessary equation of stability criteria for LTI systems in terms of Unit Impulse Response. (07)**

- B) Find the trigonometric Fourier series for the wave shown in figure : (08)



**OR**

B) Find the exponential Fourier series expansion for periodic gate function shown in figure. (consider Amplitude  $A = 1$ ). (08)



Q.4 A) For following signals, determine and sketch convolution  $y(n)$  using Graphical method (07)

$$x(n) = \begin{cases} n/3, & 0 \leq n \leq 6 \\ 0, & \text{otherwise} \end{cases} \quad \text{and} \quad h(n) = \begin{cases} 1, & -2 \leq n \leq 2 \\ 0, & \text{otherwise} \end{cases}$$

OR

A) Determine whether following CT systems are (a) static or dynamic, (b) Time variant or Invariant (07)  
(c) Linear or Nonlinear (d) Causal or Noncausal (e) Stable or unstable.

1)  $y(n) = x(n) \cos 100\pi n$

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

B) Determine the z-transform and ROC of the following signal. (08)

[1]  $x(n) = (n + 1) u(n)$

[2]  $x(n) = (-1)^n 2^{(-n)} u(n)$