

**R15****Code No: 123AW****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech II Year I Semester Examinations, March - 2017****SIGNALS AND SYSTEMS****(Common to ECE, EIE, ETM)****Time: 3 Hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART-A**

- 1.a) Determine whether a unit step signal  $u(t)$  is energy or power signal. (25 Marks) [2]  
b) Define principle of orthogonality. [3]  
c) Define sampling Theorem. [2]  
d) Compare Fourier series and Fourier transform. [3]  
e) Explain with suitable example what is meant by an LTI system. [2]  
f) Define system Bandwidth and signal Bandwidth. [3]  
g) List the properties of Cross-correlation. [2]  
h) Define Noise and state its properties with respect to correlation. [3]  
i) List out the properties of Laplace transform. [2]  
j) What is meant by region of convergence in Z Transform? [3]

**PART-B**

- 2.a) Derive the expression for trigonometric Fourier series coefficients. (50 Marks)  
b) State the Dirichlet's conditions for existence of Fourier series. [6+4]
- OR**
- 3.a) Test the orthogonality of the signals  $\sin \omega t$  and  $\cos 2 \omega t$  over the interval  $(t_0 \text{ to } t_0 + T)$ .  
b) Find the exponential Fourier series of the signal  $x(t) = 5 \cos 5t + 10 \sin 15t$ . [5+5]
- 4.a) Find the Fourier transform of  $x(t) = e^{-at} u(t)$ .  
b) State and prove the convolution property of Fourier transform. [5+5]
- OR**
- 5.a) State and prove Parseval's energy theorem.  
b) If  $x(t)$  has Fourier transform pair  $X(\omega)$ . Deduce the Fourier Transform of  $X(at - t_0)$ . [5+5]
- 6.a) Define Transfer function and state its relation with Impulse function.  
b) Find the impulse response of a continuous time LTI system with  $H(s) = \frac{s-1}{(s+1)(s+2)}$  such that i)  $\operatorname{Re}[s] > -2$  ii)  $-1 < \operatorname{Re}[s] < -2$  [3+7]

**OR**

- 7.a) Derive the relation between Bandwidth and Rise time.  
b) Determine whether the system governed by the equation  $y(n) = 5x(n)$  is linear or not. Assume that  $x(n)$  represents the input to the system and  $y(n)$  represents its output. [5+5]
- 8.a) Determine the convolution of the signals  $X(n) = \{2, -1, 3, 2\}$  and  $h(n) = \{1, -1, 1, 1\}$   
b) What is the necessary and sufficient condition on impulse response for stability? [6+4]
- OR**
- 9.a) What is the overall impulse response  $h(n)$  when two systems with impulse responses  $h_1(n)$  and  $h_2(n)$  are connected in parallel and in series?  
b) State and prove properties of convolution. [5+5]
- 10.a) The unilateral Laplace transform of  $f(t)$  is  $\frac{1}{s^2 + s + 1}$ . What is the unilateral Laplace Transform of  $tf(t)$ .  
b) Find the inverse Laplace transform of the functions  
i)  $Y(s) = 105 / (s+2)^2 (s+8)$   
ii)  $Y(s) = 105 / (s+2)^3 (s+8)$  [5+5]
- OR**
11. Find the Laplace transform of following functions:  
a) Exponential function  
b) Unit Step function  
c) Damped sine function. [3+3+4]

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