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Total Number of Pages : 02

B.Tech  
PET3I103

3<sup>rd</sup> Semester Regular/Back Examination 2017-18

SIGNAL & SYSTEMS

BRANCH : ECE, ETC

Time : 3 Hours

Max Marks : 100

Q.CODE : B1199

Answer Question No.1 and 2 which are compulsory and any four from the rest.

The figures in the right hand margin indicate marks.

**Q1 Answer the following questions: multiple type or dash fill up type (2 x 10)**

- a) A system is said to be defined as non causal, when  
a) the output at the present depends on the input at an earlier time  
b) the output at the present does not depend on the factor of time at all  
c) the output at the present depends on the input at the current time  
d) the output at the present depends on the input at a time instant in the future
- b) Construct the inverse system of  $y(t) = 2x(t)$   
a)  $y(t) = 0.5x(t)$       b)  $y(t) = 2x(t)$   
c)  $y(2t) = x(t)$       d)  $y(t) = x(2t)$
- c) Comment on the linearity of  $y[n] = n \cdot x[n]$ .  
a) Linear      b) Only additive  
c) Not scalable      d) Non linear
- d) Find where the signal  $x(t) = 1/(t^2 - 3t + 2)$  finds its maximum value between (1.25, 1.75):  
a) 1.40      b) 1.45      c) 1.55      d) 1.50
- e) Does the system  $h(t) = \exp(-7t)$  correspond to a stable system?  
a) Yes      b) No      c) Marginally Stable      d) None of the mentioned
- f) What is the possible range of frequency spectrum for discrete time fourier series (DTFS)?  
a) 0 to  $2\pi$       b)  $-\pi$  to  $+\pi$       c) Both a & b      d) None of the above
- g) What should be the value of Laplace transform for the time-domain signal equation  $e^{-at} \cos \omega t \cdot u(t)$ ?  
a)  $1/s+a$  with ROC  $\sigma > -a$       b)  $\omega/(s+a)^2 + \omega^2$  with ROC  $\sigma > -a$   
c)  $s+a/(s+a)^2 + \omega^2$  with ROC  $\sigma > -a$       d)  $a\omega/s^2 + \omega^2$  with ROC  $\sigma > 0$
- h) Which theorem states that the total average power of a periodic signal is equal to the sum of average powers of the individual fourier coefficients?  
a) Parseval's Theorem      b) Rayleigh's Theorem  
c) Both a) & b)      d) None of the above
- i) Consider the assertions given below  
A : CDF is a monotonously increasing function  
B : PDF is a derivative of CDF & is always positive  
Which among them is correct according to the properties of PDF?  
a) A is true & B is false      c) Both A & B are true but B is a reason for A  
b) A is false & B is true      d) Both A & B are false since B is not a reason for A
- j) Which is/are the mandatory condition/s to get satisfied by the transfer function for the purpose of distortion-less transmission?  
a) Amplitude Response should be constant for all frequencies  
b) Phase should be linear with frequency passing through zero  
c) Both a & b  
d) None of the above

- Q2 Answer the following questions: Short answer type (2 x 10)**
- State the time scaling property of Laplace transform.
  - What is the z transform of  $\delta(n + k)$ ?
  - Find the Fourier series representation of signal  $x(t) = \frac{\cos 2\pi t}{3}$  and determine the Fourier series coefficient.
  - Convolve the following signals  $\delta(t - 1)$  and  $u(t - 1)$ .
  - Find the Laplace transform of  $x(t) = e^{-at}u(t)$ .
  - State the condition of convergence of Fourier series.
  - State the multiplication property of DTFT.
  - Write the state variable equation of a DT-LTI system.
  - If  $X(\omega)$  is the DTFT of  $x(n)$ , then what is the DTFT of  $x(-n)$ ?
  - Find the Nyquist rate of the signal  $x(t) = \sin 200\pi t - \cos 100\pi t$ .
- Q3 a) Convolve the following signals (10)**  
 $x(t) = e^{-3t}u(t)$   
 $h(t) = u(t + 3)$
- b) Evaluate the fundamental period of the signal  $x(t) = 2 \sin(2t + 1) + 3 \sin(4t - 1)$ . (5)**
- Q4 a) a) Find the Laplace transform and sketch the pole zero plot and ROC for the signal  $x(t) = e^{-3t}u(t) + e^{2t}u(-t)$ . (10)**  
**b) What is meant by aliasing? (5)**  
**b) Prove that discrete time convolution is Associative. (5)**
- Q5 a) Explain the properties of convolution integral. (10)**  
**b) Discuss the block diagram representation for LTI discrete time systems. (5)**
- Q6 a) Check the system  $y(n) = \log_{10}|x(n)|$  is linear, time invariant, causal and static. (10)**  
**b) Find the Fourier transform of (5)**  
 $x(t) = e^{-|t|}$  for  $-1 < t < 1$   
 $= 0$  otherwise
- Q7 a) Find the Z-transform of the given signal  $x(n)$  and find ROC. (10)**  
 $x(n) = [\sin(w_0 n)]u(n)$   
**b) Give the relation between Discrete Time Fourier Transform (DTFT) and Z-Transform. (5)**
- Q8 a) A causal LTI system is described by (10)**  
 $y[n] - \frac{5}{6}y[n - 1] + \frac{1}{6}y[n - 2] = x[n]$ .  
Where  $x[n]$  is the input to the system,  $h[n]$  is the impulse response of the system. find  
a) System function  $H(z)$   
b) Impulse response  $h(n)$   
**b) Describe the sampling operation and explain how aliasing error can be prevented. (5)**
- Q9 a) Write notes on : (10)**  
a) Parseval's theorem for DTFT  
b) Deterministic and random signal  
**b) Describe the state variable model for discrete time systems. (5)**