

**Fourth Semester B.E. Degree Examination, Dec.2014/Jan.2015**  
**Signals & Systems**

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting at least TWO questions from each part.**

**PART - A**

- 1 a. Define signal and system with example. And briefly explain operations performed on independent variable of the signal. (06 Marks)
- b. Determine whether the following signal is energy signal or power signal and calculate its energy or power  

$$x(t) = \text{rect}\left(\frac{t}{T_0}\right) \cos \omega_0 t.$$
 (04 Marks)
- c. Find whether the following system is stable, memory less, linear and time invariant?  

$$y(t) = \sin[x(t+2)]$$
 (04 Marks)
- d. Two signals  $x(t)$  and  $g(t)$  as shown in Fig. Q1 (d). Express the signals  $x(t)$  in terms of  $g(t)$ . (06 Marks)

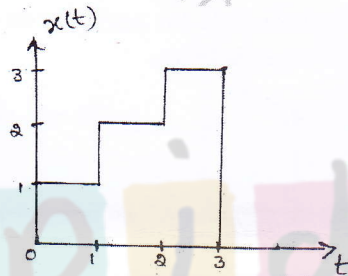


Fig. Q1 (d) - (i)

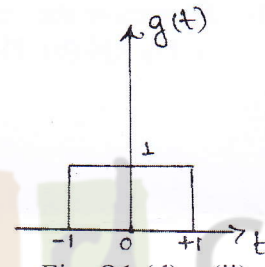


Fig. Q1 (d) - (ii)

- 2 a. Given the signal  $x(t)$  as shown in Fig. Q2 (a). Sketch the following:

i)  $x(-2t+3)$

ii)  $x\left(\frac{t}{2}-2\right)$

(04 Marks)

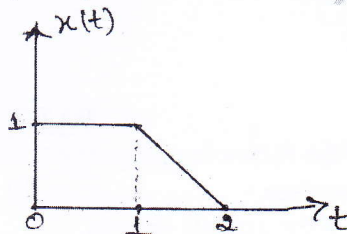


Fig. Q2 (a)

- b. For a DT LTI system to be stable show that,

$$S \triangleq \sum_{K=-\infty}^{K=+\infty} |h(K)| < \infty$$

(05 Marks)

- c. Two discrete time LTI systems are connected in cascade as shown in Fig. Q2 (c). Determine the unit sample response of this cascade connection. (06 Marks)

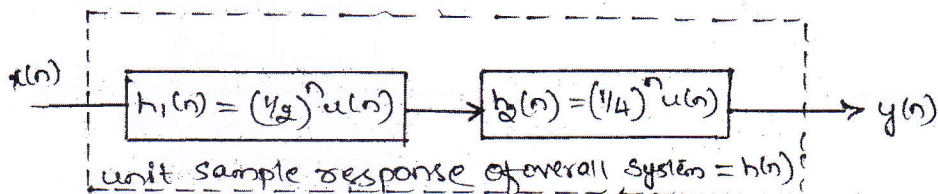


Fig. Q2 (c)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.



- 6 a. Consider the continuous time LTI system described by,
- $$\frac{d}{dt}y(t) + 2y(t) = x(t)$$
- Using FT, find the output  $y(t)$  to each of the following input signals.
- $x(t) = e^{-t}u(t)$
  - $x(t) = u(t)$
- (08 Marks)
- b. Find the Nyquist rate and Nyquist interval for each of the following signals:
- $x(t) = \sin^2(200t)$
  - $x(t) = 2 \sin c(50t) \sin(5000\pi t)$
- (06 Marks)
- c. An LTI system is described by  $H(f) = \frac{4}{2 + j2\pi f}$  find its response  $y(t)$  if the input is  $x(t) = u(t)$
- (06 Marks)
- 7 a. Define ROC and list its properties. (04 Marks)
- b. State and prove time reversal property of z-transform. (04 Marks)
- c. Determine the inverse z-transform of  $x(z) = \frac{1}{(1+z^{-1})(1-z^{-1})^2}$ ; ROC;  $|z| > 1$  (06 Marks)
- d. Determine z-transform and ROC of  $x(n) = \left(\frac{1}{3}\right)^n \sin\left(\frac{\pi}{4}n\right)u(n)$  (06 Marks)
- 8 a. A causal, stable discrete time system is defined by,
- $$y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n) - 2x(n-1)$$
- Determine
- System function  $H(z)$  and magnitude response at zero frequency.
  - Impulse response of the system.
  - Output  $y(n)$  for  $x(n) = \delta(n) - \frac{1}{3}\delta(n-1)$
- (12 Marks)
- b. Solve the following difference equation for the given initial conditions and input,
- $$y(n) - \frac{1}{9}y(n-2) = x(n-1)$$
- With  $y(-1) = 0$ ,  $y(-2) = 1$  and  $x(n) = 3u(n)$
- (08 Marks)

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