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Total Number of Pages: 2

**B.Tech**  
**PCBM4302**

**5<sup>th</sup> Semester Regular / Back Examination 2016-17**

**SIGNALS AND SYSTEMS**

**BRANCH(S): CSE, IT, ITE**

**Time: 3 Hours**

**Max Marks: 70**

**Q.CODE: Y381**

**Answer Question No.1 which is compulsory and any five from the rest.  
The figures in the right hand margin indicate marks.**

**Q1 Answer the following questions: (2 x 10)**

- State whether the following discrete time system is static or dynamic where  $y(n) = \log_{10}|x(n)|$
- State whether the following system is BIBO stable or not where  $y(n) = x(n) - x(-n-1) + x(n-1)$
- Prove that  $a_0 = 0$  and  $a_n = 0$  (where  $a_0$  and  $a_n$  represents trigonometric Fourier Series Coefficients) if  $x(t)$  exhibits odd symmetry.
- Find the Fourier transform of A (constant).
- Find the Z transform of  $x^*(n)$ .
- Determine the energy and power of a d.t. unit step signal.
- Find the DFT of  $\delta(n)$ .
- Find the DFT of a purely real and even signal  $x(n)$ .
- Distinguish between FIR and IIR systems.
- Prove that autocorrelation at zero lag represents energy of a discrete time signal  $x(n)$ .

**Q2 Define autocorrelation and cross correlation. Show that autocorrelation is an even function of lag 'l' and it is maximum at zero lag. (2+8)**

**Q3 a) Prove that the Parseval's relation in the Z domain (5)**

$$\sum_{-\infty}^{\infty} x_1(n)x_2^*(n) = \frac{1}{2\pi j} \int X_1(Z)X_2^*\left(\frac{1}{Z^*}\right)Z^{-1}dZ$$

- b) Find the linear convolution between  $x_1(n) * x_2(n)$  where (5)**  
 $x_1(n) = \{1, \frac{2}{3}, 3, 4\}$  and  $x_2(n) = \{-1, 0, \frac{1}{3}, 2\}$  using graphical method.

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**Q4 a)** Perform a 4 point circular convolution using DFT/IDFT method where **(5)**  
 $x_1(n) = \{-1, 2, -3, 4\}$  and  $x_2(n) = \{4, 7, 2\}$

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**b)** Determine the inverse Z transform of  $X(Z) = \ln \frac{\alpha}{\alpha - z^{-1}}$  ROC  $|z| > \frac{1}{\alpha}$  **(5)**

**Q5 a)** Determine all possible values of  $x(n)$  for  $X(Z) = \frac{z^3 + z^2 + 1.5z + 0.5}{z^3 + 1.5z^2 + 0.5z}$  **(5)**

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**b)** An LTI system is described by the difference equation **(5)**  
 $y(n] = x(n) + 0.81x(n-1) - 0.81x(n-2) - 0.45x(n-2)$ . Determine the system function of the system. Sketch the poles and zeros on the Z plane. Assess the stability.

**Q6 a)** Solve the following difference equation using unilateral Z transform **(5)**

$$y(n] - \frac{7}{12}y(n-1) + \frac{1}{12}y(n-2) = x(n] \text{ for } n \geq 0 \text{ with initial conditions } y(-1) =$$

$$2; y(-2) = 4 \text{ and } x(n] = \left(\frac{1}{5}\right)^n u(n]$$

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**b)** Define circular convolution. Derive the circular convolution relation **(5)**  
between  $x_1(n]$  and  $x_2(n]$

**Q7** Find the Fourier transform of periodic impulse train having amplitude 1 **(10)**  
and time period  $T_0$ . Find the trigonometric form of Fourier series of the  
half wave rectified sine wave having peak amplitude A

**Q8** Write short answer on any TWO: **(5 x 2)**

**a)** Gibb's phenomena

**b)** Sampling theorem

**c)** Parseval's relation

**d)** Stability analysis in the Z domain