Printed pages: 3

K. N. I. T., SULTANPUR

(Paper code and roll No. to be filled in your answer book)

Paper code: KEC-404

Roll No. | | 5 | 4 | 1 | 2 | | | | | |

B.Tech. (Main & COP)

Fourth Semester Theory Examination 2016-17

Signals & Systems

Time: 3 Hours **Total Marks: 100**

Note Attempt all questions. Draw diagrams if required.

1. Attempt any four parts of the following: (5x4=20)

(a) Let $x_{1(t)}$ and $x_2(t)$ be periodic signals with fundamental periods T_1 and T_2 respectively. Under what conditions is the sum $x(t) = x_1(t) + x_2(t)$ periodic and what is the fundamental period of x(t) if it is periodic.

(b) Consider $x(t) = e^{-2t} u(t)$. Is it a power signal or energy signal?

(c) Sketch the signals (i) $u(-t+1)$ (ii) $u(t+2)$ (iii) $x(t) = -2u(t-1)$ (iv) $x(t) = -2\, r(t)$. (v) $x(t) = r(-t+2)$.

(d) Define deterministic, random, odd, even and periodic signals with the help of examples.

(e) Determine the deterministic, random, odd, even and periodic signals with the help of examples.

(f) Prove that (i) the product of two even signals is even (ii) the product of an even signal and an odd signal is odd.

2. Attempt any four parts of the following: (5x4=20)

(a) Find the Laplace Transform and associated regions of convergence of the signal $x(t) = e^{at} \cos \omega t$.

(b) Find x(t), $t \geq 0$ if its unilateral Laplace transform, X(s) is given by $X(s) = \dfrac{1+e^{-3s}}{s^2(s+1)}$.

(c) Using Laplace Transform method, solve the following differential equation for the given initial conditions $\dfrac{d^2y(t)}{dt^2} + 5\dfrac{dy(t)}{dt} + 6y(t) = \delta(t) + 6u(t)$. With $x(0^-) = 1$ and $x'(0) = 2$.

(d) Find the Z Trans form of $x(n) = A^n u(n) + B^n u(-n-1)$ and find out the ROC.

(e) Find the inverse Z-Trans form using long division method

$$X(Z) = \frac{z}{(3z-1)(z-1)}.$$

(f) Solve the difference equation using Z-Trans form method $x(n-2) - 9x(n-1) + 18x(n) = 0$. Initial conditions are $x(-1) = 1$, $x(-2) = 9$.

3. Attempt any two parts of the following: (10x2=20)

(a)(i) Find and plot the magnitude and phase spectra of the signal $x(t) = A\ e^{-t/T} u(t)$.

(ii) Find the Fourier Trans form of signal $x(t) = \cos(\omega_o t)$.

(b) Find the Fourier Trans form of the signal shown in Fig.1

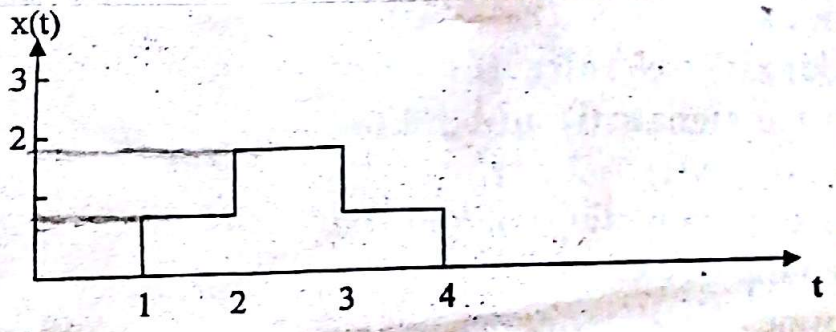

Fig 1

(c) Find the Fourier trans form of the following and sketch the magnitude and phase spectra of the signal $x(t) = e^{-at} u(t)$.

4. Attempt any two parts of the following: (10x2=20)

(a) If x(t) and y(t) are shown in Fig. 2. Determine graphically the signal $z(t) = x(t) * y(t)$

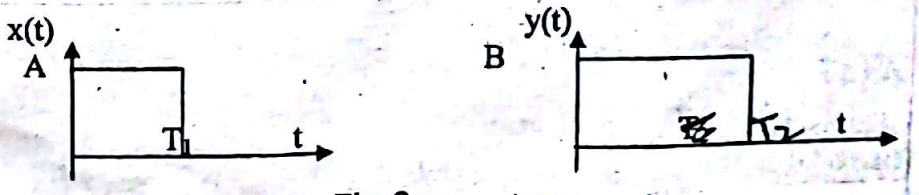

Fig. 2

(b) For the RC low pass filter as shown in Fig. 3. find the impulse response and step response

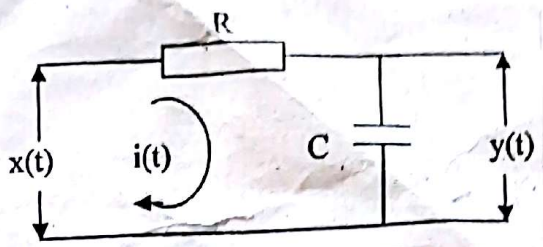

Fig. 3

(c) What is correlation of two sequence? Find the zero lag value of the auto-correlation function of the signal $x(t) = 10Cos\left(\frac{\pi t}{T}\right)$; $-\frac{T}{2} \le t \le \frac{T}{2}$.

5. Attempt any two parts of the following: (10x2=20)

(a) Realize $H(s) = \frac{s^2 + 4s + 2}{s^2 + 5s + 3}$ in direct form II.

(b) Obtain canonical direct form and parallel realizations of the transfer function $H(s) = \frac{5s^3}{s^3 + 6s^2 + 11s + 6}$

(c) In the given circuit (Fig. 4) the switch K is suddenly closed at t=0. The capacitor was initially uncharged and there was no current flowing through the inductance at t= 0. Determine the current $i_1(t)$ for $t > 0$.

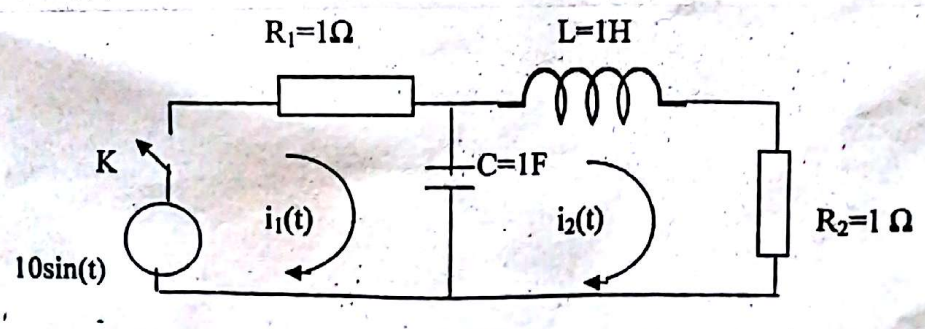

Fig. 4