(Pages : 3) **A – 2771**

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Sixth Semester B.Tech. Degree Examination, May 2016
(2013 Scheme)
13.606 : SIGNALS AND SYSTEMS (R)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all, each** carries **4** marks.

1. Find the Nyquist rate for the signal $x(t) = \sin(40\pi t)$ and $\cos(50\pi t)$.
2. Find the Z-transform and ROC for, $x(n) = (0.5)^{n+1} u(n+1)$.
3. State and prove the time-scaling properties of the DFT.
4. Define DCT. What are its advantage compared to DFT ?
5. Realize the filter using minimum number of multipliers,

   $H(z) = 1 + 2z^{-1} + 3z^{-2} + 3z^{-3} + 2z^{-4} + z^{-5}$.

PART – B

Answer **any one** question from **each** Module.

Module – 1

6. a) x (t) is as shown in figure 1. Draw
   i) x ((2/3)t) and ii) x (–t –1) **8**

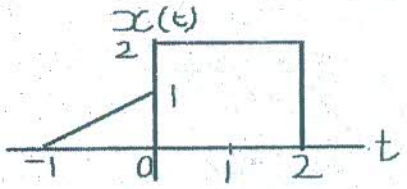

Fig. 1

   b) Check for linearity, stability, causality and time invariance.
   i) $y(n) = x(t) \cos(\omega t)$ ii) $y(n) = \log(x(n))$. **12**

OR

7. a) Sketch the double sided amplitude and phase spectra of $x(t) = 2\sin[2\pi t - \pi/2]$. 6

   b) Find the frequency response and plot the magnitude and phase for,

   $x(n) = 1$ for $n = -2, -1, 0, 1, 2$

   $= 0$, otherwise. 14

Module – 2

8. a) Find the convolution between the sequences, $p(n) = \{1, 2, 1, -1\}$ and $q(n) = (-1, \underset{\uparrow}{1}, 2, 1\}$. 6

   b) Solve the differential equation, $d^2y/dt^2+3dy/dt+2y = 4$. 6

   c) Find the Laplace transform of $f(t) = \cos(bt)e^{-t}u(t)$. 8

OR

9. a) Find the Fourier transform of the periodic impulse train, defined as, 10

   $\delta_T(t) = \sum_{k=-\infty}^{\infty} \delta(t - nT)$.

   b) An LTI system is defined as $y(n) - 0.5y(n-2) = x(n)$, find the output of the system when $x(n) = \delta(n)$. 10

Module – 3

10. a) Find the trigonometric Fourier series for the signal shown in Fig. 2 10

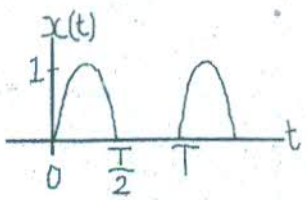

Fig. 2

   b) Find the Z-transform and ROC of $r^n \dfrac{\sin[(n+1)\omega]}{\sin\omega}$. 10

OR

11. a) A discrete system is defined by the equation,

$y(n) - 1/2\, y(n-1) + 1/8\, y(n-2) = x(n) - x(n-2)$. From the pole-zero plot find whether the system is stable or not. 10

b) Determine the zero input and zero state response by using unilateral Z-transform, for, $y(n) - (1/2)\, y(n-1) = x(n) - (1/2)\, x(n-1)$; $x(n) = u(n)$; $y(-1) = 0$. 10

Module – 4

12. a) Compare parallel and cascade structures. 4

b) Obtain the lattice structure for the FIR filter, $H(z) = 1 + 1/2z^{-1} + 1/3z^{-2}$. 8

c) Draw the decimation in frequency FFT algorithm to calculate the DFT of the sequence $x(n) = \{1, 0, 1, -1\}$. 8

OR

13. a) Draw the first order cascade and parallel realization structures for,

The system function, $H(z) = \dfrac{3 + 3.6z^{-1} + 0.6z^{-2}}{1 + 0.1z^{-1} - 0.2z^{-2}}$. 12

b) Draw the direct form linear phase structure for M = 8. 8