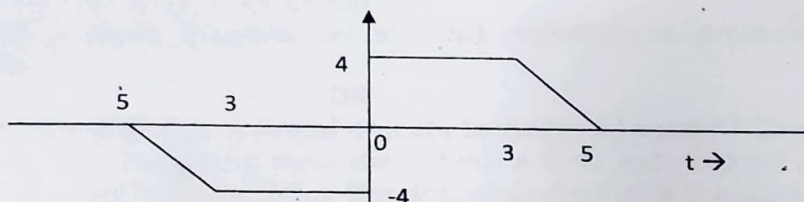


**END TERM EXAMINATION****FIFTH SEMESTER [B.TECH] DECEMBER 2017****Paper Code: IT-307****Subject: Digital Signal Processing****Time: 3 Hours****Maximum Marks: 75****Note: Attempt any five questions including Q.no.1 which is compulsory.****Assume missing data if any.**

- Q1 Attempt any five: (5x5=25)
- Find the Fourier Coefficient of the signal  $f(t) = \sin \omega_0 t$ .
  - Verify following system for Linearity and Time Invariance:  
(i)  $y(t) = x^2(t)$ , (ii)  $y(t) = \sin t \cdot x(t)$ , (iii)  $y(t) = x(at)$ , and (iv)  $y(t) = \log x(t)$ .
  - What is the difference between Causal System or Non-Causal System.
  - Prove that discrete time harmonics are not always periodic in frequency.
  - Find the Fourier Coefficient of the signal which is full wave rectifier signal.
  - Write a short note filter bank.
  - Compare IIR and FIR.
  - Explain the need of low pass filter with a decimator and mathematically prove that  $\omega_x = \omega_y D$ .
  - Short note on Frequency Sampling realization of FIR filters.

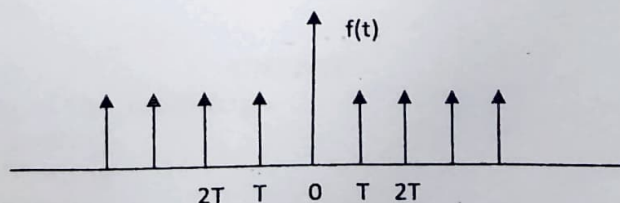
- Q2 (a) Signal  $f(t)$  is defined as below: (6.5)



A signal  $g(t)$  is realized by multiplying  $f(t)$  with  $\delta(t+4) + \delta(t-4)$  is the integral of the signal or power signal. Hence find the Energy or Power.

- (b) Find the response of discrete time LTI system having the input and impulse responses as given below  $f[n] = a^n u[n]$ ,  $h[n] = a^n u[n]$ . (6)

- Q3 (a) Derive the relationship between Trigonometric Fourier Series and Exponential Fourier Series. (6.5)
- (b) Draw the Complex Spectrum of the given below and also find the Fourier series. (6)

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- Q4 (a) Find the Fourier Transform of the signal.  
 (i)  $f(t) = \frac{1}{\pi t}$ , (ii)  $f(t) = t \left( \frac{\sin t}{\pi t} \right)^2$  (6.5)
- (b) Find the number of complex additions and complex multiplications required to find DFT for 16 point signal. Compare them with number of computations required, if FFT algorithm is used. (6)
- Q5 (a) Compute DFT of a sequence,  $x(n) = \{1, 2, 2, 2, 1, 0, 0, 0\}$  using DIF-FFT algorithm. Sketch its magnitude spectrum. (6.5)  
 (b) Find 8-point FFT of,  $x(n) = \{1, 2, 2, 2, 1\}$  using signal flow graph of Radix-2 Decimation in frequency FFT. (6)
- Q6 Derive the Expression for impulse invariance technique for obtaining transfer function of digital filter from analog filter. Derive necessary equation for relationship between frequency of analog and digital filter. (12.5)
- Q7 Compare various windows used for designing FIR filters. (12.5)
- Q8 Compare various windows used for designing FIR filters. (12.5)

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