

**Signals & Systems Paper - V**

P. Pages : 3

Time : Three Hours



KNT/KW/16/7272/7277

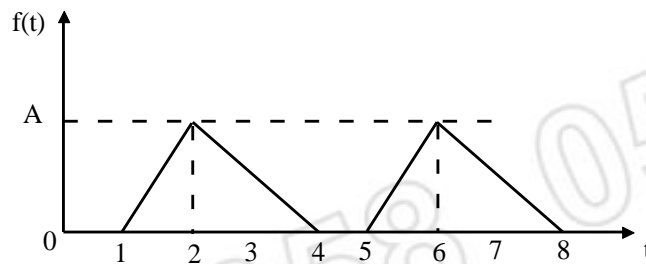
Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.
  11. Use of non-programmable calculator is permitted.

1. a) State and prove scaling property of Fourier Transform. What is the physical significance of this property? 6
- b) Find Fourier transform for given function. 7
- i) Double sided exponential signal. ii)  $U(t) \cos \omega t$ .

**OR**

2. a) Find out Fourier Transform of the following function. 8



- b) Find inverse Fourier Transform of. 5
- i)  $\delta(\omega)$  ii)  $\delta(\omega + \omega_0)$
3. a) If a function  $f(t)$  is given as  $f(t) = A \cos(\omega t + \phi)$  then find out 6
- i) Auto correlation function. ii) Power spectral density.
- b) What is the difference between ensemble and time average? State the conditions for a process to be stationary, wide sense stationary or ergodic. 7

**OR**

4. a) A Rayleigh density function is given by 8

$$f_x(x) = \begin{cases} xe^{-\frac{x^2}{2}} & ; x \geq 0 \\ = 0 & ; x < 0 \end{cases}$$

Find : i)  $F_x(x)$   
ii)  $P(0.5 < x \leq 2)$

b) A random experiment consists of drawing two cards from a deck in succession. Assign a value to the probability of obtaining two red aces in two draws. 5

5. a) Derive the expression for power spectral density of NRZ Bipolar signaling and draw the PSD characteristics. 7

b) Explain in brief Inter Symbol Interference (ISI). How we can reduce ISI? 7

OR

6. a) The data 10101101 is to be transmitted. Draw the waveforms for the following signaling methods. 8

- |                 |                            |
|-----------------|----------------------------|
| i) Unipolar NRZ | ii) Polar RZ               |
| iii) Bipolar RZ | iv) Split phase Manchester |

b) What is line coding? Explain properties of line coding. 6

7. a) What is single side band modulation technique? Explain phase shift method to generate SSB signal. 7

b) Explain FM threshold effect in detail. 6

OR

8. a) Write detailed notes on **any two**. 13

- i) Envelop detector & square Law demodulator.
- ii) Delta modulation system.
- iii) A - law and  $\mu$  - law Companding.
- iv) Pulse code modulation.

9. a) Draw ASK, PSK and FSK waveforms for the following sequences. 9

- i) 11110000
- ii) 10101010
- iii) 10111010

b) Write short notes on M-ary communication systems. 4

OR

10. a) What is differential PSK? Explain DPSK with suitable block diagram. Discuss advantages and disadvantages of DPSK system. **8**

b) Write a short note on matched filter detection of binary signals. **5**

11. a) A Zero memory source emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1 and 0.08. Find the quaternary Huffman code for this source as well as calculate code efficiency and the redundancy. **7**

b) For a (6,3) systematic Linear Block code, the generator matrix is given by **7**

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 \end{bmatrix}$$

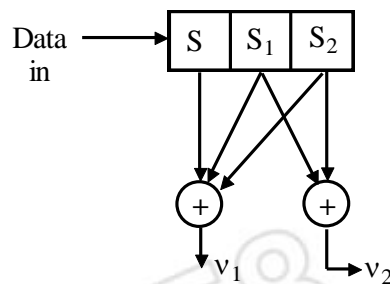
Construct the code generated by this matrix and determine the error correcting capabilities of this code.

**OR**

12. a) For a (7,4) cyclic code, the generator polynomial is given by  $g(x) = x^3 + x^2 + 1$ . Find all corrected vectors for the following received vectors. **8**

- i) 1011001
- ii) 1010111
- iii) 1111111
- iv) 0101101

b) For the convolutional encoder shown below, draw the code tree and state table. **6**



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