

**GUJARAT TECHNOLOGICAL UNIVERSITY****M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014****Subject code: 1722202****Date: 03-12-2014****Subject Name: Advanced Digital Communication****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a)** Explain significance of Hilbert transform. Compare Hilbert transform with FT. enlist all properties of Hilbert transform and prove any two properties. **07**

**(b)** Describe stochastic process. **07**

**Q.2 (a)** Explain representation of band pass signal in terms of low pass signal. Justify if  $s(t)$  is real valued band pass signal then its equivalent low pass signal  $S_L(t)$  is complex valued signal. **07**

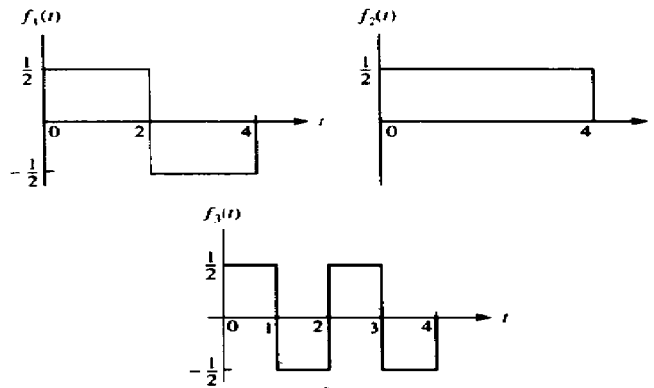
**(b)** Consider three wave form  $f_n(t)$  shown in below figure. **07**

- 1) Show that these wave forms are orthonormal.

- 2) Express wave form  $x(t)$  as a weighted linear combination of  $f_n(t)$  where  $n=1,2,3$

$$x(t) = \begin{cases} -1 & (0 \leq t < 1) \\ 1 & (1 \leq t < 3) \\ -1 & (3 \leq t < 4) \end{cases}$$

And determine weighting coefficient.

**OR**

**(b)** Justify with necessary derivation autocorrelation function  $\phi_{nn}(\tau)$  of the band pass stochastic process is uniquely determined from auto correlation function  $\phi_{zz}(\tau)$  of equivalent low pass process  $z(t)$  and carrier  $f_c$ . **07**

**Q.3 (a)** Sketch binary PAM and prove that correlation coefficient of two signal is -1. **07**

**(b)** For M ary phase modulated signal prove that minimum Euclidian distance of adjacent signal phase is **07**

$$d_{min}(\theta) = \sqrt{E_s \left(1 - \cos \frac{2\pi}{M}\right)}$$

**OR**

**Q.3 (a)** Explain in detail matched filter type demodulator for optimum receiver. **07**

**(b)** Write short note on OFDM. **07**

- Q.4 (a)** Explain in detail maximum likelihood sequence detector for optimum receiver. **07**
- (b)** Digital information is to be transmitted by carrier modulation through an additive Gaussian noise channel with band width of 100 KHz and  $N_0=10^{-10}$  w/Hz. Determine maximum rate that can be transmitted through channel for 4 PSK, Binary PSK and 4 frequencies orthogonal FSK which is detected non co herently. **07**
- OR**
- Q.4 (a)** Describe carrier recovery technique for M ary PSK and M ary PAM using decision feedback PLL. **07**
- (b)** A speech signal is sampled at rate of 8KHz logarithmically compressed and encoded in to PCM format using 8 bits/sample. The PCM data is transmitted through AWGN base band channel via M level PAM. determine band width requirement for transmission when **07**
- 1)  $M = 4$
  - 2)  $M = 8$
  - 3)  $M = 16$
- Q.5 (a)** With proper block diagram explain how carrier recovery is achieved using costas loop. **07**
- (b)** Explain how carrier recovery is achieved using square law device? **07**
- OR**
- Q.5 (a)** Explain effect of ISI on eye opening and prove Nyquist condition for zero ISI. **07**
- (b)** Write short note on Design of Band limited signals with controlled ISI. **07**

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