**6th Semester BE (CBCS) EC/TC Model Question Papers 15EC61**

**Visvesvaraya Technological University, Belagavi**

**MODEL QUESTION PAPER**

**6th Semester, B.E (CBCS) EC**

**Course: 15EC61 - Digital Communication**

**Max Marks: 80 Time: 3 Hours**

**Note: (i) Answer Five full questions selecting any one full question from each Module.**

**(ii) Question on a topic of a Module may appear in either its 1st or/and 2nd question**.

**Module 1**

1 (a) Define Hilbert Transform. State the properties of it. **4**

(b) Define the complex envelope of bandpass signals. Obtain the canonical representation of bandpass

signals 6

(c) Derive the power spectral density of polar NRZ signals and plot the spectrum. 6

**OR**

2 (a) Define the Pre-envelope. Show the spectral representations of pre-envelopes for low pass signals. 4 (b) Derive the expression for the complex low pass representation of bandpass systems. 7

(c) Given the data stream 1110010100. Sketch the transmitted sequence of pulses for each of the following line code.

(i) Unipolar NRZ

(ii) Polar NRZ

(iii) Unipolar RZ

(iv) bipolar RZ

(v) Manchester code. 5

**Module 2**

3 (a) Explain the Geometric representation of signals and express the energy of the signal in terms of the signal vector. 5

(b) Explain the Gram-Schmidt orthogonalization procedure. 5

(c) Explain the matched filter receiver with the relevant mathematical theory. 6

**OR**

4 (a) Obtain the decision rule for Maximum likelihood decoding and explain the correlation receiver. 7 (b) The waveforms of four signals s1(t), s2(t), s3(t), and s4(t) described below. s1(t) = 1, 0 < t < T/3, s2(t) = 1, 0 < t < 2T/3, s3(t) = 1, T/3 < t < T, 9 s4(t) = 1, 0 < t < T, and zero otherwise. Using the Gram-Schmidt orthogonalization procedure, find an orthonormal basis for this set of signals and construct the corresponding signal-space diagram.

**Module 3**

5 (a) Define binary phase shift keying. Derive the probability of error of BPSK. 7

(b) Define M-ary QAM. Obtain the constellation of QAM for M=4 and draw the signal space diagram 4

(c) Given the input binary sequence 1100100001. Sketch the waveforms of the inphase and quadrature components of a modulated wave and next sketch the QPSK signal. 5

**OR**

6 (a) Describe the QPSK signal with its signal space characterization. With a neat block diagram explain the generation and detection of QPSK signals. 6

(b) Obtain the expression probability of symbol error of coherent binary FSK. 7

(c) Illustrate the operation of DPSK for the binary sequence 10010011 3

**Module 4**

7 (a) With a neat block diagram Explain the digital PAM transmission through bandlimited baseband channels and obtain the expression for ISI. 5

(b) What are adaptive equalizers? Explain the linear adaptive equalizer based on the MSE criterion. 6

(c) The binary sequence 10010110010 is the input to the precoder whose output is used to modulate a duobinary transmitting filter. Obtain the precoded sequence, transmitted amplitude levels, the received signal levels and the decoded sequence. 5

**OR**

8 (a) What is eye pattern? What is the Nyquist criterion for zero ISI? Given an example of the pulse with zero ISI. 5

(b) Explain the design of bandlimited signals with controlled ISI. Describe the time domain and frequency domain characteristics of a duobinary signal. 5

(c) What is channel equalization? With a neat diagram explain the concept of equalization using a linear transversal filter. 6

**Module 5**

9 (a) Draw the 4 stage linear feedback shift register with 1st and 4th stage is connected to Modulo-2 adder. Output of Modulo-2 is connected to 1st stage input. Find the output PN sequence and obtain the autocorrelation sequence. 6

(b) With a neat block diagram explain the frequency hopped spread spectrum. 7

(c) Explain the effect of dispreading on narrowband interference. 3

**OR**

10 (a) Explain the generation of direct sequence spread spectrum signal with the relevant waveforms and spectrums. 6

(b) With a neat block diagram explain the CDMA system based on IS-95. 7

(c) Write a short note on application of spread spectrum in wireless LANs. 3