T. E. (Computer) (Sem II) (Rev) 2011/06
Principle of Digital Communication

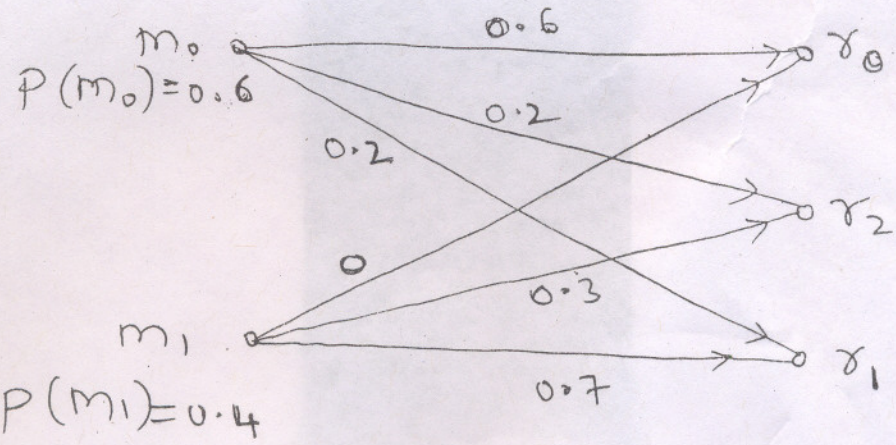
Con. 4697-06. (REVISED COURSE) YM-6697

(3 Hours) [Total Marks : 100

N.B.: (1) Question No. **1** is **compulsory**.
(2) Attempt in all **five** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Draw **neat diagrams** wherever **necessary**.

1. (a) Why is it often preferred to use units of normalized bandwidth, WT, compared with bandwidth alone ? 4
(b) Often times, providing more E_b/N_o will not mitigate the degradation due to intersymbol interference (ISI). Explain why this is the case. 4
(c) ASK or PSK is visualized as a constellation of points or phasors on a plane. Why can't we use a similarly simple visualization for orthogonal signalling such as FSK. 4
(d) What is the relationship between received S/N ratio and C/N ratio ? 4
(e) Why do error-correcting codes typically yield error-performance degradation at low values of E_b/N_o ? 4

2. (a) Define cumulative distribution function and probability density function. List their properties. 10
(b) For the communication system shown in **figure**, m_0 would generate r_0, and m_1 would generate r_1 with certainty if there were no noise and r_2 would never occur. For the situation depicted in **figrue**. 10
(i) Find the optimum receiver and (ii) Calculate the probability of error.



3. (a) Consider two waveforms $\cos(2\pi f_1 t + \phi)$ and $\cos 2\pi f_2 t$ to be used for noncoherent FSK-signaling, where $f_1 > f_2$. The symbol rate is equal to 1/T symbols/s, where T is the symbol duration and ϕ is a constant arbitrary angle from 0 to 2π. 10
(i) Prove that the minimum tone spacing for non-coherently detected orthogonal FSK-signaling is 1/T.
(ii) What is the minimum tone spacing for coherently detected orthogonal FSK-signaling ?
(b) Explain the transmitter and receiver of BFSK. Also draw the signal space diagram of orthogonal BFSK. 10

4. (a) An analog siganl is band limited to B Hz, sampled at the Nyquist rate, and the samples are quantized into 4-levels. The quantization levels Q_1, Q_2, Q_3 and Q_4 (messages) are assumed independent and occur with probabilities $P_1 = P_4 = \frac{1}{8}$ and $P_2 = P_3 = \frac{3}{8}$. find the information rate of the source. 8
(b) Explain the Shannon's information capacity theorem. Show that channel capacity for channels of intinite bandwidth is $C_{S\infty} = 1{\cdot}44\ S/\eta$ bits per sec. 8
(c) Explain Shannon limit. 4

5. (a) Explain in convolution code, time-domain approach, and transform-domain approach to determine encoder output. 10
(b) Source coding reduces redundancy and discards irrelevent content. What is the difference between redundancy and irrelevency ? Also explain Huffman code. 10

6. (a) Explain in brief the following codes :—
(i) BCH-Code 5
(ii) R-S-Code. 5
(b) Draw a model of a cryptographic channel and explain. Also write two major requirements of cryptosystem. 8+2

7. Write short notes on the following :— 6

(a) Sky noise temperature. 7

(b) PCM waveform types. 7

(c) Intersymbol interference and equalization.