

Time: 3 Hours

**DECEMBER 2015**

Max. Marks: 100

**PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.**

**NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following: (2×10)**

- a. A CD audio laser-disk system has a frequency bandwidth of 20 Hz to 20 kHz. The minimum sample rate to satisfy the Nyquist criteria is  
(A) 20 Hz (B) 20 KHz  
(C) 40 Hz (D) 40 KHz
- b. The quantizing error of PCM systems for weak signals can be made less significant by  
(A) Companding (B) Using TDM  
(C) Using FDM (D) Filtering out Alias Frequency
- c. Using an oscilloscope to display overlaid received data bits that provide information on noise, jitter, and linearity is called  
(A) Eye pattern (B) Constellation pattern  
(C) Statistical concentration (D) None of these
- d. A source alphabet consists of N symbols with the probability of the first two symbols being the same. A source encoder increases the probability of the first symbol by a small amount  $\epsilon$  and decreases that of the second by  $\epsilon$ . After encoding, the entropy of the source  
(A) Increases (B) Remains the same  
(C) Increases only if  $N = 2$  (D) Decreases
- e. In PCM system, the number of quantization levels are 16 and the maximum signal frequency is 4 kHz, the bit transmission rate is  
(A) 64 kbps (B) 16 kbps  
(C) 32 kbps (D) 8 kbps
- f. The maximum data rate that a medium of 10 kHz and signal to noise ratio of 30dB is roughly -  
(A) 10 kbps (B) 30 kbps  
(C) 100 kbps (D) 3 kbps

- g. The Nyquist sampling rate for the signal  $g(t)$  is given by  $g(t) = 4 \sin(200\pi t) \sin(400\pi t) + 3 \sin(500\pi t)$
- (A) 200 (B) 300  
(C) 400 (D) 500
- h. The main advantage of polar NRZ over Manchester format is:
- (A) Saving in power (B) Noise immunity  
(C) Synchronization is lost (D) None of these
- i. The number of quantization levels required to reduce the quantization noise by a factor of 4
- (A) 1024 (B) 512  
(C) 256 (D) 64
- j. A communication channel with AWGN operating at a signal to noise ratio,  $SNR \gg 1$  and bandwidth  $B$  has capacity  $C_1$ . If the SNR is doubled keeping bandwidth constant, the resulting capacity  $C_2$  is given by (approximately)
- (A)  $2C_1$  (B)  $C_1+B$   
(C)  $C_1+2B$  (D)  $C_1+3B$

**Answer any FIVE Questions out of EIGHT Questions**  
**Each question carries 16 marks**

**Q.2** a. Draw the block diagram of digital communication system and explain the function of each block. Differentiate the system with analog communication. **(8)**

b. A discrete memoryless source (DMS) has six symbols  $X_i$  and their probability of occurrence  $P(X_i)$  as follows:

<u><math>X_i</math></u>	→	<u><math>P(X_i)</math></u>
$X_1$	→	$0.30$
$X_2$	→	$0.25$
$X_3$	→	$0.20$
$X_4$	→	$0.12$
$X_5$	→	$0.08$
$X_6$	→	$0.05$

Using Huffman coding algorithm, find the Huffman codes for the symbols. Calculate the coding efficiency. **(8)**

**Q.3** a. State and explain sampling theorem. **(6)**

b.  $g(t)$  is a band limited signal with bandwidth  $f_m$  Hz and its spectrum is given in Fig (a). Mathematically show that the spectrum of the sampled (at sampling frequency of  $f_s$  Hz) version of signal  $g(t)$  is as given in Fig (b). **(10)**

