## T.E./Insem.-126
## T.E. (E&TC )
## DIGITAL COMMUNICATION
## (2012 Pattern) (Semester - I)

*Time : 1 Hour]*                                                                    *[Max. Marks : 30*

*Instructions to the candidates:*
1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

*Q1)* a) A compact disc(CD) records audio signals digitally by PCM. Assume audio signal's bandwidth to be 15kHz. If signals are sampled at a rate 20% above nyquest rate for practical reasons and the samples are quantised into 65,536 levels, determin bits/sec required to encode the signal and minimum bandwidth required to transmit encoded signal. **[5]**

   b) With the help of diagram explain function of each block of digital communication system. **[5]**

OR

*Q2)* a) A waveform $[10 + 10 \sin(500t + 30°)]$ is to be sampled periodically and reproduced from these sample values. Find the maximum allowable time interval between sample values. How many sample values are needed to be stored in order to reproduce one second of this waveform? **[5]**

   b) What is the necessity of companding? Explain the A law companding graphically with expression. **[5]**

*Q3)* a) Draw AT and T hierarchy multiplexing system and explain in detail. **[5]**

b) Explain properties of line codes and draw power spectral density of unipolar NRZ, polar RZ AMI, and Manchester. **[5]**

OR

*Q4)* a) What is Inter Symbol Interference (ISI)? Explain the ideal solution to control ISI. **[5]**

b) The data stream 10101010001 is an input to a scramble shown in fig. Obtain the scrambled output assuming initial content of all registers to be zero **[5]**
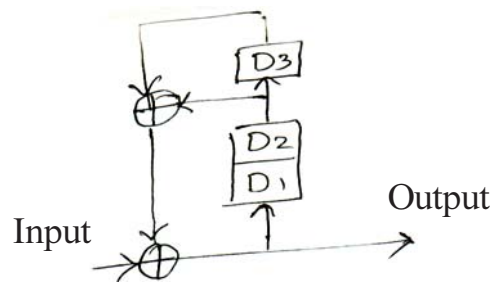


*Q5)* a) Consider a random process X(t) given by $X(t) = A \sin(Wt+\theta)$

where A and W are constants and $\theta$ is a random variable over $(\theta, -2\pi)$ show that X(t) is weak sense stationary process. **[5]**

b) Show that power spectral density forms fourier transform pair with autocorrelation function. **[5]**

OR

*Q6)* a) Define following terms with respect to random process **[5]**
   i) Ensembles
   ii) Sample function
   iii) Ensemble averages
   iv) Time averages
   v) Random variable

b) Let X(t) be a zero mean, stationary, Gaussian process with autocorrelation function $R_x(t)$. This process is applied to a square law device. Which is defined by the input output relation. $Y(t) = X^2(t)$ where Y(t) is the output show that the mean of Y(t) is $R_x(0)$. **[5]**

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