Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: B.Tech
Sub_Code: REC5C002

5th Semester Back Examination: 2025-26
SUBJECT: Analog and Digital Communication
BRANCH(S): ECE, ETC
Time: 3 Hours
Max Marks: 100
Q.Code: U402

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Define DSB-SC modulation.
b) Define Cumulative Density Function (CDF) and Probability Density Function (PDF).
c) Mention any two characteristics of white noise.
d) Find the Nyquist rate of x(t) = 10 Cos (2000πt) + 20Sin (8000πt)) + 4Cos (4000πt)
e) What will be the required transmission bandwidth of a band-limited channel of R_s = 1 Msps and roll-off factor $\alpha = 0.25$?
f) What will be the number of bits/samples for a PCM system having 8 quantization levels and sampling rate 6 kHz?
g) Write the difference between coherent and non–coherent detection.
h) Define Pulse Code Modulation (PCM).
i) State Nyquist criterion for zero ISI in digital communication.
j) Draw the block diagram of FSK transmitter and receiver.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) With a neat diagram, explain the frequency domain representation of signals.
b) Discuss SSB generation methods.
c) Explain the spectral characteristics of angle modulated signals.
d) Derive an expression for the output SNR of an AM receiver in the presence of noise.
e) Explain the effect of pre-emphasis and de-emphasis in FM.
f) Describe Delta modulation with a suitable block diagram.
g) Explain TDM with a neat timing diagram.
h) Describe optimum detection of signals in noise.
i) What is modulation? Consider the frequency modulated signal x(t) = 10 Cos [$2\pi \times 10^5 t$ + 5 sin ($2\pi \times 1500t$) + 7.5 Sin ($2\pi \times 1000t$)] with a carrier frequency of 10^5 Hz. Find the modulation index.

j) An AM transmitter radiates 4000 W with 90 % modulation. Calculate the carrier power, sideband power, and power in each sideband.

k) Calculate the FM bandwidth using Carson's rule for a signal with f_m = 2.5 KHz and Δf = 12 KHz and compare it with the bandwidth required for AM.

l) Write short notes on Equalization techniques.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Draw the trellis diagram for a (2,1,3) convolutional code with generator matrix. **(8)**

b) A delta modulation system has step size 0.4 V and maximum signal slope 1.5 V/ms. Determine the sampling frequency. **(8)**

Q4 **a)** Derive the expression for matched filter output. **(8)**

b) Draw eye diagram for ISI and explain how Nyquist pulse eliminates it. **(8)**

Q5 **a)** A digital system transmits symbols 1 and 0 with equal probability. AWGN = $N_0/2$ and transmitted energy per bit = Eb. Find probability of bit error for BPSK. **(8)**

b) Derive the power spectral density for MSK signaling. **(8)**

Q6 **a)** A digital link has ISI of 25 % symbol amplitude. Design an equalizer to minimize error. **(10)**

b) Explain synchronization in QAM-based carrier recovery loops. **(6)**