

Noakhali Science and Technology University
Department of Computer Science and Telecommunication Engineering
3rd Year 1st Term B.Sc. (Engg.) Final Examination-2024

Course Code: CSTE 3101 Course Title: Communication Engineering

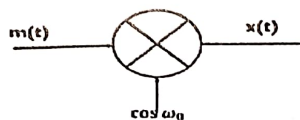
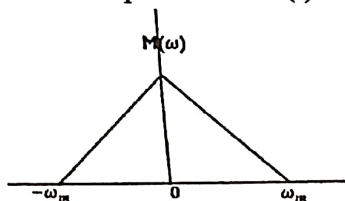
Time: 4 hours.

Total Marks: 70

[Answer any seven of the following questions. Figures in the right-hand margin indicate full marks]

1. a) Why does the antenna height need to decrease for communication system and how it is decrease derive from equations? 3
- b) If the voice signal $m(t)$ ranges from 300 Hz to 3.4 kHz then draw continuous time Fourier transform graph. 2
- c) How we get frequency shifting property in the modulated signal? Explain. 3
- d) Write the advantages and disadvantages of modulation. 2

- a) Which type of filter used in demodulation technique. Discuss quadrature null effect in synchronous detection technique. 2
- b) If $m(t) = B \cos \omega_m t$ and index $\mu = 1$, then find $\phi_{AM}(t)$ and sketch it. 2
- c) Draw the spectrum of $x(t)$ of the following system: 3



- d) Explain on-off keying ASK technique. 3

- a) Derive single tone time domain expression for AM signal with appropriate waveform. Draw the spectrum of AM signal. 5
- b) The power content of the carrier of an AM wave is 200W. The peak amplitude of the modulating signal is 10V having 50W power content. Determine modulation index and modulation efficiency. 5

- a) Compare between DSB full carrier and DSB-SC AM modulation. 4
- b) Write a few drawbacks of DSB full carrier AM modulation technique. How can we overcome those drawbacks? 3
- c) In an AM transmitter, modulation index is 0.65 and unmodulated carrier voltage is 400Vrms. Find the minimum and maximum amplitude of modulating wave. 3

- a) Discuss generation of SSB-SC AM from DSB-SC AM. 3
- b) Draw the spectrum of SSB-SC for both single tone and multiple frequency message signal. 3
- c) Why not SSB-SC used in video signal transmission? Which technique is used instead? 4

- a) Prove that a binary source can produce maximum entropy when both symbols are equiprobable. 5
- b) A black and white TV picture element consists of 500 lines of picture information. Assume that each line consists of 525 picture elements and each element have 250 brightness level. Pictures are repeated at rate of 30/sec. Calculate entropy and average rate of information content by TV set to viewer. 5

- a) Define Marginal, Conditional and Joint entropy. 4.5
- b) Show that $H(X, Y) = H\left(\frac{X}{Y}\right) + H(Y)$ where the symbol's carry usual meaning. 4
- What is Information rate? 1.5

8. a) What is mutual information? Write down the properties of mutual information system. 4
 b) The joint probability of a system is given by $P(X, Y)=$ 6

	y_1	y_2
x_1	0.5	0.25
x_2	0	0.125
x_3	0.0625	0.0625

Find mutual information between X and Y .

9. a) Derive the expression for signal to quantization error ratio. 4
 b) Two analog signals having BWs 500 Hz and 200 Hz are sampled at 20% higher than Nyquist rates, encoded with 8 bit words and time division multiplexed. Find the bit rate for the multiplexed signal. 3
 c) A voice grade channel of telephone network has a BW of 3.4 kHz. Calculate the information capacity of the channel for a signal to noise ratio of 30 dB. 3