



SPRING END SEMESTER EXAMINATION-2024

4th Semester B.Tech

COMMUNICATION ENGINEERING

EC2016

(For 2021 & Previous Admitted Batches)

Time: 2 Hours 30 Minutes

Full Marks: 50

Answer any FIVE questions.

Question paper consists of three SECTIONS i.e. A, B and C.

Attempt minimum one question each from each Section.

The figures in the margin indicate full marks.

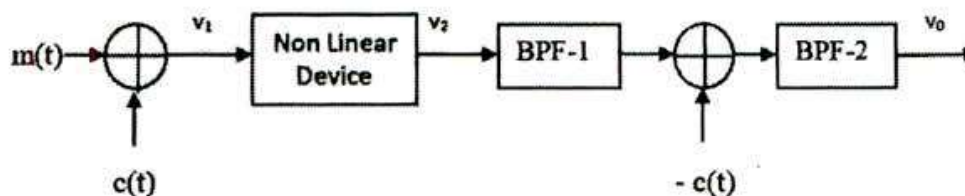
All parts of a question should be answered at one place only.

SECTION-A

1. (a) Estimate the Fourier Transform of a gate pulse of width 4τ and strength 2, located at origin. Sketch the magnitude and phase response. [5]

- (b) In the below figure $m(t) = 4\cos 200\pi t$, $c(t) = 10\cos 2000\pi t$, [5]

$$v_2 = v_1 + 0.1 * v_1^2$$



Band Pass Filter-1 has pass band from 800 Hz to 1200 Hz. Now determine the cut off frequencies of Band Pass Filter-2 such that you will get an Upper Side Band signal v_0 . Determine the time domain equations of v_1 , v_2 and v_0 . Also sketch their spectra in the frequency domain.

2. (a) Discuss the working of Ring modulator with neat diagram and waveforms. [5]

- (b) Describe FDM with proper block diagram. State its advantages and disadvantages. Four signals each band-limited to 5, 9, 11, 14 kHz are transmitted through FDM channel simultaneously and the modulators used are AM, SSB, DSB and VSB respectively. Determine the minimum bandwidth of FDM channel assuming a guard band of 0.4kHz and vestige bandwidth of 0.2kHz. [5]

SECTION-B

3. (a) Discuss the cellular concept in mobile communication. How does it differ from traditional wireless communication? How does frequency reuse aid to system capacity? [5]
- (b) Draw the block diagram of PCM system. An input signal with amplitude range -2 V to $+2\text{ V}$ and spectral components in frequency band 300 Hz to 3000 Hz has an average signal power 12 mW. It is transmitted using PCM system. The required SNR is 30 dB. Specifying the number of quantization levels needed in PCM system using uniform quantizer. [5]
4. (a) State and prove the sampling theorem. How can aliasing be avoided? How can we reconstruct a signal from its samples? [5]
- (b) Explain phase discrimination method of generation for SSB-SC signal. [5]
5. (a) Explain the Quadrature Null effect with mathematical justification. State the different modulation techniques where it may occur. [5]
- (b) A Superheterodyne receiver having RF amplifier is tuned to 555 kHz. The Local Oscillator is tuned to 1010 kHz and $Q=50$. Calculate [5]
- i. intermediate frequency

ii. image frequency

iii. Image Frequency Rejection Ratio

SECTION-C

6. (a) Why the Armstrong method is called the indirect method of FM generation. Design the block diagram of an Armstrong indirect FM modulator to generate an FM carrier with a carrier frequency of 98.1 MHz and $\Delta f = 75$ kHz. The available Narrow-band FM has a carrier frequency of 100 kHz and a frequency deviation $\Delta f = 10$ Hz. A stock room also has an oscillator with an adjustable frequency in range 10 to 11 MHz. There are plenty of frequency doublers ($\times 2$), triplers ($\times 3$), quintuplers ($\times 5$) are available. [5]
- (b) Illustrate the block diagram of a satellite communication system and assess the role of uplink and downlink. [5]
7. (a) A sinusoidal signal band limited to 5kHz is transmitted through a PCM channel. Given the sampling rate is thrice the Nyquist rate and the maximum quantization error is 0.1% of the peak signal amplitude. Determine [5]
- A. Sampling Frequency
 - B. Code-word length
 - C. Transmission bandwidth
 - D. Final bitrate
 - E. Output signal to quantization noise ratio.
- (b) What is BFSK? With the proper mathematical analysis explain the generation and detection of BFSK signal and also draw the signal space diagram? List the differences between BPSK and BFSK. [5]
