5. (a) What is pulse time modulation? Explain one method of generation of PWM and PPM. (6)

(b) Derive an expression for signal to quantization noise ratio for PCM uses uniform quantization techniques. (4)

(c) Draw the compressor and expander characteristics and also discuss A law of companding and μ law of companding. (5)

6. (a) The first stage of a two stage amplifier has a voltage gain of 10, input resistance 600 Ω, equivalent noise resistance 1600 Ω and output resistance 27 kΩ. For the second stage these values are 25, 81 kΩ, 10 kΩ and 1 MΩ respectively. Find the equivalent noise resistance of this two stage amplifier. What do you mean by delta modulation? (8)

(b) Discuss the advantages and disadvantages of delta modulation. Also explain adaptive delta modulation. (7)

7. Write short notes on following :

(a) Calculation of noise figure. (5)

(b) TDM and FDM. (5)

(c) Square law diode modulation. (5)

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015305

January 2023

B.Tech. (ENC) III SEMESTER

Analog Communication (ECP-304)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Differentiate between continuous time signal and discrete time signal. (1.5)

(b) How is the height of antenna related to modulation? Also explain how modulation helps in reducing the height of antenna. (1.5)

(c) If $x(t) \leftrightarrow X(\omega)$, use the Fourier transform properties, find the Fourier transform of $y(t) = x(3t - 6)$. (1.5)

(d) A signal is sampled at Nyquist rate of 8 kHz and is quantized using 8 bit uniform quantizer. Calculate the bit rate, SNRq and bandwidth. (1.5)

(e) Determine the Nyquist rate and Nyquist interval for the signal :

$x(t) = 3 \cos (50 \pi t) + 10 \sin (300 \pi t) + \cos (100 \pi t)$ (1.5)

(f) Find the overall noise figure of a three stage cascaded amplifier, each stage having a power gain of 10 dB and noise figure of 6 dB. (1.5)

(g) The maximum deviation allowed in an FM broadcast system is 75 kHz. If the modulating signal is single tone sinusoidal of frequency 8 kHz. Determine the bandwidth of FM signal. (1.5)

(h) Determine the power content of each of sidebands and of the carrier of an AM signal that has a percent modulation of 75% and contains 1500 W of total power. (1.5)

(i) Distinguish between uniform and non-uniform quantization. (1.5)

(j) Calculate the frequencies available in the frequency spectrum of AM wave, when 2 MHz carrier is modulated by two sinusoidal signals of 3 kHz and 2 kHz. (1.5)

PART–B

2. (a) State and prove following properties of Fourier transform :

(i) Frequency shifting property.

(ii) Convolution in time domain. (6)

(b) Find the Fourier transform of gate function of amplitude A and pulse width τ. (5)

(c) Find the inverse Fourier transform of

$$X(\omega) = 2[\delta[\omega - 1) - \delta(\omega + 1)] + [\delta(\omega - 2\pi) + \delta(\omega + 2\pi)]$$ (4)

3. (a) What is balanced modulator? Sketch a balanced modulator circuit and explain its working. Derive the expression for its output voltage. (7)

(b) Explain the circuits of envelope diode detector. Explain how it works and mention the condition to be satisfied to avoid clipping in the output. (8)

4. (a) Explain the difference between narrow band FM and wide band FM. Derive an expression for narrow band FM. Also give statement of Carson's rule. (7)

(b) Draw the circuit diagram of varactor diode modulator and explain its working. (5)

(c) A frequency modulated signal describe by the equation:

$S(t) = 10 \cos [2\pi \times 10^6 t + 0.1 \sin (2000 \pi t)]$

(i) Find the power of modulated signal.

(ii) Find the frequency deviation.

(iii) Estimate the bandwidth of S(t). (3)