

Con. 3596-10.

AN-3487

**(REVISED COURSE)**

(3 Hours)

[ Total Marks : 100 ]

**N.B.** (1) Question No. 1 is compulsory.

(2) Attempt any four questions from remaining six questions.

(3) Assume suitable data if required and state it clearly.

1. Answer the following questions (any four) :— 20
- (a) Explain capture effect in FM receivers.
  - (b) How does non-linear mixing differ from linear summing ?
  - (c) What are the errors in Delta Modulation ?
  - (d) AM is a waste of power and bandwidth. Justify the statement.
  - (e) Consider the analog signal—  

$$x(t) = 3 \cos 50\pi t + 10 \sin 300 \pi t + \cos 100 \pi t$$
 What will be the Nyquist rate and Sampling rate of the signal.
2. (a) Explain the Block diagram of PCM with function of each block. What is the bandwidth required for PCM. 10  
 If a voice signal is sampled at Nyquist rate and each sample is quantized into one of 256 levels, determine the output rate of PCM signal.
- (b) Draw the block diagram with sketches of waveforms at each stage for an ISB transmitter operating at 22.275 MHz without pilot carrier and with two side bands of 3 KHz each. 10
3. (a) Derive the expression for mathematical representation of FM. 8
- (b) Distinguish between High Level Modulation and Low Level Modulation. 6
- (c) A mixer stage has a Noise figure of 20 dB and this is preceded by an amplifier with a Noise figure of 9 dB and an available power gain of 15 dB. Calculate overall Noise figure referred to the input. 6
4. (a) Draw the block diagram of Armstrong Frequency Modulation system and explain its working. Illustrate the principle of operation with the help of suitable vector diagrams. 10
- (b) For an AM broadcast band superhetrodyne receiver with RF and IF frequencies of 600 KHz and 455 KHz respectively, Determine— 6
- (i) Local oscillator frequency
  - (ii) Image frequency
  - (iii) Image frequency rejection ratio for a preselector  $\theta$  of 100.
- (c) Explain FM noise triangle. 4

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5. (a) State and prove sampling theorem for a low pass bandlimited signal. Explain aliasing error. 10
- (b) How does a digital system regenerate a signal after noise has corrupted it with no degradation in SNR? 6
- (c) Derive an expression for noise voltage. 4
6. (a) What are the limitations of TRF receivers and how are they overcome using other receivers? 8
- (b) How is PPM generated and demodulated? 6
- (c) An AM transmitter supplies a 110 kW of carrier power to  $50 \Omega$  load. It operates at a carrier frequency of 1.2 MHz and is 80% modulated by 3 KHz sinewave. for this system— 6
- (i) Sketch the frequency spectrum.
- (ii) Find average power in dB.
- (iii) Peak and RMS values of signal.
7. (a) Write short notes on any two of the following :— 12
- (i) Automatic Gain Control
- (ii) Noise in Communication Systems
- (iii) Quantization Error
- (b) The centre frequency of an LC oscillator to which a capacitor reactance FET modulator is connected is 70 MHz, The FET has a  $g_m$  which varies linearly from 1 ms to 2 ms and a bias capacitor whose reactance is 10 times the resistance of the bias resistor. If the fixed tuning capacitance across the oscillator coil is 25 pf, calculate the maximum frequency deviation produced. 8