



VIT[®]

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

23BEE091

Final Assessment Test(FAT) - Apr/May 2025

Programme	B.Tech.	Semester	Winter Semester 2024-25
Course Code	BECE304L	Faculty Name	Prof. Ralph Samuel Thangaraj
Course Title	Analog Communication Systems	Slot	F1+TF1
		Class Nbr	CH2024250500880
Time	3 hours	Max. Marks	100

Instructions To Candidates

- Write only your registration number in the designated box on the question paper. Writing anything elsewhere on the question paper will be considered a violation.

Course Outcomes

- CO1: List and analyse the key elements of analog communication system.
 CO2: Design the various Amplitude Modulation Schemes and evaluate in terms of its power, bandwidth and transmission Efficiency.
 CO3: Examine the various angle modulation schemes.
 CO4: Infer the working principle of radio transmitters and receivers.
 CO5: Analyse the effect of noise on various analog modulations.
 CO6: Analyse various pulse modulation and multiplexing techniques

Section - I

Answer all Questions (4 × 10 Marks)

- (i) Discuss the importance of modulation techniques in terms of multiplexing, long range and bandwidth. [5 marks]

(ii) Write two key differences between wired and wireless communication system. Determine the optimum antenna height required for long range audio signal transmission using carrier signal from the X-band. [5 marks]

[10] (CO1/K1)
- (i) Explain the process of Frequency Modulated signal generation using varactor diode. Justify that the variation of output frequency is due to change in varactor diode capacitance. [5marks]

(ii) How we can generate the Phase Modulated wave using frequency modulator? Draw the block diagram and explain the process. [5 marks]

[10] (CO3/K2)
- Consider an angle-modulated signal $X_c(t) = 100 \cos[2\pi f_c t + 5 \sin(2\pi f_m t)]$. Assume PM and $f_m = 1$ kHz. Compute the phase-modulation index and approximate bandwidth of Phase Modulated signal. Determine the approximate bandwidth of Phase Modulated signal when (a) f_m is halved, and (b) f_m is doubled.

[10] (CO3/K2)
- (i) A multiplexer needs to be used to accommodate 5 signals. The signals need to be converted to digital signals before transmission. Assume that 3 of the signals are speech signals with a maximum frequency of 4KHz and the remaining two are music signals at 20 KHz. If we are going to represent each sample with an 8-bit code, what would be the bit rate the multiplexer should be able to manage? How much extra bandwidth (in terms of bit rate) would be needed if we go from using 8-bits to 10-bits to encode a sample value? [5Marks]

(ii) Identify and explain the pulse modulation technique that varies width of the carrier pulse in accordance with the amplitude of message signal pulse to control the electric device rotation. [5 marks]

[10] (CO6/K2)

Section - II

Answer all Questions (4 × 15 Marks)

- (i) Identify the demodulator that uses square law device and Low Pass Filter to extract the low level modulated message signal. Explain the process with neat block diagram and point out its limitation. [7 marks]

(ii) An Amplitude Modulation signal has a peak unmodulated carrier voltage, $V_c = 100$ V, a load resistance, $R_L = 50 \Omega$, and a modulation index, $m_a = 1$. Determine the following: (a) The carrier power (b) The lower-sideband and upper-sideband power (c) Total sideband power (d) Total power of the modulated AM signal and (e) Sketch the AM power spectrum [8 marks]

[15] (CO2/K2)

06. (i)- A carrier signal with frequency of 1 MHz is modulated by two-tone modulating signals having frequencies 1 kHz and 3 kHz respectively.
(a)- List the frequencies contained in AM, DSB-SC and SSB(USB) signals. (4 Marks)
(b)- Draw Single Side Band (USB) waveform in both time domain and frequency domain. (4 Marks)
* (ii)- Explain the method of SSB generation with neat block diagram and equations without using 90° phase shifter for the modulating signal. Also show that two separate oscillator are required while generating SSB signal. [7 marks]

[15] (CO2/K2)

07. (i)- An AM commercial broadcast-band receiver (535 kHz – 1605 kHz), an input filter is used with Q-factor of 54. Determine its bandwidth at both the low and high ends of RF spectrum. Comment on the received signal quality. [5 marks]
(ii)- Explain three most important performance characteristics parameters of a radio receiver with neat graph. [5 marks]
(iii)- Differentiate between low level and high level modulation with neat block diagram of RF amplifier stages. Write 2 key difference between low level and high level modulation. [5 marks]

[15] (CO4/K1)

08. (i)- A DSB-SC AM receiver system consists of an antenna followed by an amplifier. The system operates at room temperature (290 K) and has a bandwidth of 10 kHz. The antenna receives a signal with power $1 \mu\text{W}$ and is affected by Johnson-Nyquist thermal noise. The amplifier has a power gain (G) of 20 dB and a noise figure (NF) of 3 dB. Find
a) Johnson Noise (2 Marks)
b) Input SNR (1 Mark)
c) Output SNR (1 Mark)
d) Check, If the Noise figure is correct. (1 Mark)

- (ii)- We want to quantify or evaluate the performance of a receiver for specific modulation schemes. What metric can we use if we require a dimensionless measure? If an AM receiver is designed to demodulate an AM signal that conserves power but not bandwidth, derive the corresponding expression along with a clear block diagram and provide the value of the relevant performance metric for such a receiver. [10 marks]

[15] (CO5/K3)

BL-Bloom's Taxonomy Levels - (K1-Remembering,K2-Understanding,K3-Applying,K4-Analysing,K5-Evaluating,K6-Creating)

