U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: Electronics and Communication Engineering **Duration: 3 hrs.**

Course Code: 23EC4PCPCS / 22EC4PCPCS **Max Marks: 100**

Course: Principles of Communication Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. The value of charge q=1.6X10^{-19} Coulomb

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Compare Amplitude Modulation (AM) in the time domain versus the frequency domain. How does these help in understanding AM signal characteristics?	*1*	*1*	**6**
	b)	A message signal of 12KHz and peak voltage 20V is used to modulate a carrier wave of frequency 12MHz and peak voltage 30V. Determine the modulation index and amplitude of the side frequencies.	*1*	*1*	**4**
	c)	For AM modulated signal given below, $S(t) = A_c (1+k_a m(t)) \cos(2\pi f_c t)$, where A_c and f_c are the amplitude and frequency of the carrier signal. Design a suitable detector to recover the modulating signal m(t) with large carrier amplitude.	*3*	*3*	**10**
		OR			
2	a)	Consider a message signal $m(t)=20\cos(2\pi t)$ volts and a carrier signal $c(t)=50\cos(100\pi)t$ volts. (i) Find the maximum and minimum envelope values of the AM modulated signal with the depth of modulation 75%. Draw the waveform of m(t), c(t) and the modulated signal. (ii) Obtain the time domain expression for the AM modulated signal and also the amplitude spectrum. (iii) Obtain the power delivered across the load of 100Ω due to this AM wave.	*1*	*1*	**7**
	b)	In the standard AM wave, if m(t) is a multi-tone signal with frequencies $f_3>f_2>f_1$ and amplitudes $A_1>A_2>A_3$, A_c is the carrier amplitude and f_c is the carrier frequency. Write mathematical expression and draw the spectrum of the modulated signal.	*1*	*1*	**5**
	c)	Discuss how the non-linearity property of a device can be used to generate AM signal. Arrive at the standard AM time-domain expression. With the help of frequency-domain analysis, comment on filter specifications.	*2*	*2*	**8**

			UNIT - II			
	3	a)	What factors lead to the development of VSB modulation? Comment on the transmission bandwidth of VSB modulation technique and give one application.	*1*	*1*	**4**
		b)	Explain generation of SSB-SC frequency discrimination method. What are the desirable filter characteristics?	-	-	**6**
		c)	For a ring modulator with input signal meaasage $m(t)=A_1\cos(\omega_m t)$ and carrier $c(t)=A_2\cos(\omega_c t)$, where A_1 and A_2 are amplitudes and ω_m and ω_c are angular frequencies, derive the expression for the output signal s(t) with a neat block diagram. Assume ideal ring modulator characteristics.	*2*	*2*	**10**
			OR			
	4	a)	Consider a resultant wave obtained by adding a non-coherent carrier $A_c \cos(2\pi f_c t + \phi)$ to a DSB-SC wave $\cos(2\pi f_c t)m(t)$. This composite wave is applied to an ideal envelope detector. Determine the resulting detector output. Evaluate this output for $\phi=0$ and $\phi\neq0$ if $A_c >> \|m(t)\|$.	*1*	*1*	**8**
		b)	Describe how the Quadrature Carrier Multiplexing achieve the separation of two different signals on the same carrier frequency.	*1*	*1*	**5**
		c)	Consider a two stage SSB modulator where the message signal occupies a band 0.3KHz to 4KHz and the two carrier frequencies are f_1=10KHz and f_2=100KHz. Evaluate the following (i) Sidebands of DSB-SC modulated waves at the output of Product modulator. (ii) The sidebands of SSB modulated waves at the output. (iii) The guard bands of the two BPF (iv) Sketch the spectrum of the signal at each stage.	*1*	*1*	**7**
			UNIT - III			
	5	a)	Explain how FM can be generated using Hartley oscillator with a neat circuit diagram.	*1*	*1*	**06**
		b)	Discuss the process of generating Phase Modulation using a Frequency Modulation and vice versa. Draw the resulting PM and FM waveforms, considering a sinusoidal modulating signal $m(t)=A_m \cos 2\pi f_m t$.	*1*	*1*	**06**
		c)	The receiver is tuned to recover the message from the appropriate incoming amplitude modulated signal. In the intermediate stage, it is required to shift the frequency f_o which is lower than a tuned frequency as a part of recovering message. Analyze the process of intermediate stage with suitable example.	*2*	*2*	**08**
			OR			
	6	a)	Explain with a block diagram, how a Zero crossing detector can be used to retrieve the message signal in FM.	*1*	*1*	**8**

		b)	A carrier is frequency modulated by a sinusoidal modulating signal of frequency 2KHz, resulting in a frequency deviation of 5KHz. (i) Determine the bandwidth occupied by the modulated waveform. (ii) If the amplitude of the modulating signal is increased by a factor 2 and its frequency lowered to 1 KHz determine the new bandwidth.	*1*	*1*	**4**
		c)	Analyze how WBFM is generated by Armstrong method of FM generation.	*2*	*2*	**8**
			UNIT - IV			
	7	a)	An FM signal with a deviation of 75 kHz is applied to an FM demodulator. When the input SNR is 15 dB, the modulating frequency is 10kHz, estimate the SNR at the demodulator output.	*1*	*1*	**6**
		b)	Obtain the expression for FOM of SSB receiver.	*1*	*1*	**10**
		c)	A noise generator using a diode is required to produce 15μV noise voltage in a receiver, which has an input impedance of 75Ω (purely resistive). The receiver has a noise power bandwidth of 200KHz. Determine the current through the diode.	*1*	*1*	**4**
			OR			
	8	a)	Analyze the effect of noise in receivers with receiver model for double side band suppressed carrier. Show that the figure of merit for DSBSC receiver is unity.	*2*	*2*	**10**
		b)	Analyze the Pre-emphasis and De-emphasis circuit with frequency responses. Show how the effect of noise on higher modulating frequencies is minimized in FM.	*2*	*2*	**10**
			UNIT - V			
	9	a)	A bandpass signal has the spectral range that extends from 20KHz and 82KHz. Find the acceptable range of sampling frequency.	*1*	*1*	**6**
		b)	Define Pulse Amplitude Modulation (PAM). If a baseband signal with a bandwidth of 4 kHz is sampled using PAM, find minimum sampling rate required to avoid aliasing.	*1*	*1*	**6**
		c)	State and prove sampling theorem & its reconstruction for lowpass signals.	*2*	*2*	**8**
			OR			
	10	a)	Explain the necessity of implementing PAM.	*1*	*1*	**05**
		b)	Explain natural and flattop sampling techniques. Sketch the spectrum of sampled signal at (i) $f_s=2f_m$ (ii) $f_s>2f_m$ (iii) $f_s<2f_m$	*1*	*1*	**10**
		c)	Describe the Time Division Multiplexing (TDM) system, illustrating its components and operation with a required block diagram.	-	-	**05**

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