U.S.N.										

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

Autonomous Institute Affiliated to VTU

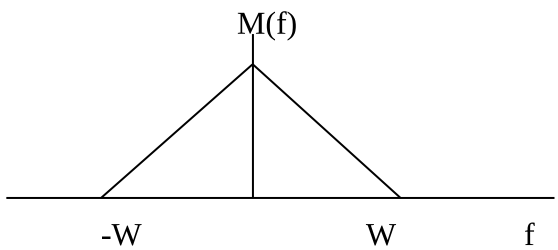
September / October 2023 Semester End Main Examinations

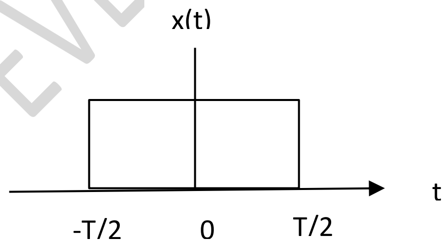
Programme: B.E. **Semester: IV**
Branch: Electronics and Telecommunication Engineering **Duration: 3 hrs.**
Course Code: 22ET4PCCS1 **Max Marks: 100**
Course: Communication Systems – 1

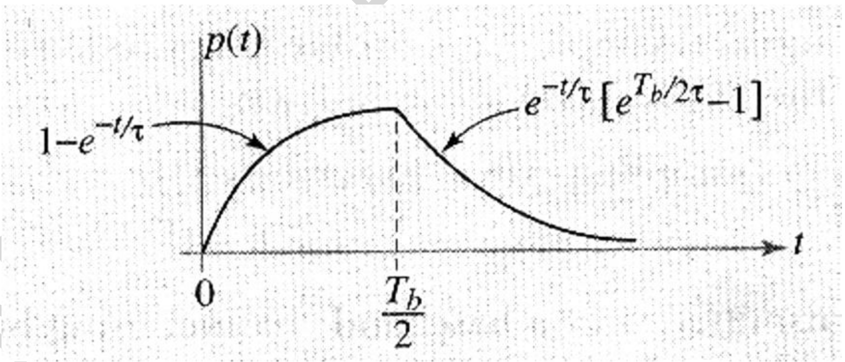
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

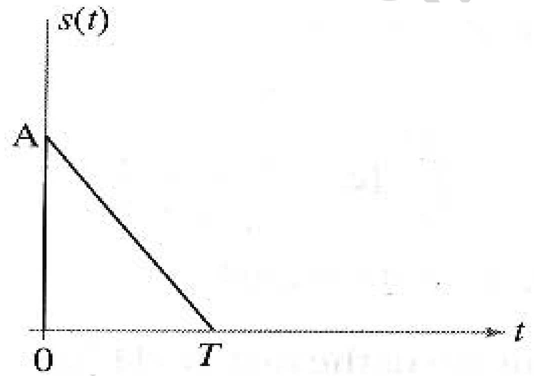
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	**Marks**
1	a)	Show that the AM signals can be demodulated by a square-law detector followed by a low-pass filter and a dc blocker. Determine the signals from input to the output at all points. Find the distortion term in the output. Show that if $A_c >> \|m(t)\|$, the distortion is small.	*CO2*	*PO1*	**06**
	b)	For a PN junction diode, the current 'i' through the diode and voltage 'v' across it related by $i = I_0[e^{-v/V_T} - 1]$. Where I_o is the reverse saturation current and V_T is the thermal voltage. At room temperature, $V_T = 0.026$ volts. (i) Expand 'i' as power series in v retaining terms upto v^2 (ii) Let $v = 0.01\cos(2\pi f_m t) + 0.01\cos(2\pi f_c t)$ volts, where f_m = 1kHz and f_c = 100kHz. Sketch the spectrum of the diode current i (iii) Specify the bandpass filter to extract from I and AM wave with carrier frequency f_c (iv) What is the percentage modulation index.	*CO3*	*PO2*	**08**
	c)	Consider a message signal m(t) with a spectrum shown in the fig below. The message bandwidth W = 1KHz. This signal is applied to product modulator together with a carrier wave $A_c \cos(2\pi f_c t)$, producing the DSBSC modulated s(t). The modulated signal is next applied to coherent detector. Determine the spectrum of the detector output when: (i) f_c = 1.25KHz (ii) f_c =0.75KHz.(iii)what is the lowest frequency for which each component of the signal s(t) is uniquely determined by m(t)	*CO3*	*PO2*	**06**



			UNIT - II			
	2	a)	Show the SSBSC modulated wave s(t) containing upper side band is defined by : $s(t) = (Ac / 2) . [m(t).\cos 2\pi\ fc\ t – m\hat{}(t). \sin 2\pi\ fc\ t]$	*CO2*	*PO1*	**06**
		b)	The single tone modulating signal $m(t) = A_m \cos(2\pi f_m t)$ is used to generate the VSB signal. $s(t) = aA_mA_c \cos[2\pi(f_c + f_m)t]$ $+(1-a)A_mA_c \cos[2\pi(f_c - f_m)t]$ Where a is constant , less than unity, representing the attenuation of the upper sideband frequency. (i) Find the in-phase and quadrature component of the VSB modulated signal s(t). (ii) What is the value of constant a for which s(t) reduces to a DSBSC modulated wave? (iii) What is the value of constant a for which s(t) reduces to an SSBSC modulated wave? (iv) The VSB wave s(t) plus the carrier $A_c\cos(2\pi f_c t)$ is he passed through an envelope detector . Determine the distortion produced by the quadrature component. (v) What is the valued of ‘a’ for which this distortion reaches its worst possible value?	*CO3*	*PO2*	**08**
		c)	Evaluate the Hilbert transform of the pulse given below:  	*CO3*	*PO2*	**06**
			UNIT - III			
	3	a)	Consider an angle modulate signal $s(t) = 10 \cos[(2\pi fct + 3 \sin(2\pi fmt)]$ (i) Assume s(t) is phase modulated signal and f_m 1kHz. Calculate the modulation index and find the bandwidth when (a) f_m is doubled (b)f_m is decreased to one-half. (ii) Assume s(t) is frequency modulated signal and f_m 1kHz. Calculate the modulation index and find the bandwidth when (a) f_m is doubled (b)f_m is decreased to one-half.	*CO2*	*PO1*	**06**

		b)	Analyze the effect of nonlinearities in FM system with suitable mathematical equations and one sided spectrum.	CO2	PO1	**08**
		c)	Analyze the importance of Pre-emphasis and De-emphasis with relevant sketches.	CO2	PO1	**06**
			OR			
	4	a)	Obtain Fourier series representation of the single tone FM signal s(t) for an arbitrary value of β and also draw the spectrum.	CO2	PO1	**06**
		b)	Show that a PLL can be used in the demodulation of FM wave with relevant mathematical equations.	CO2	PO1	**08**
		c)	With appropriate equations and block diagram, analyze the generation of FM using direct method.	CO2	PO1	**06**
			UNIT - IV			
	5	a)	Derive the 6dB rule for Uniform quantization from basic terminologies. Determine the minimum number of levels and corresponding SNR_q of a PCM system if the output SNR_q is to be held at 50dB.	CO2	PO1	**06**
		b)	Consider a received baseband PAM pulse p(t) shown below. Consider the input as $y(t) = \sum_k A_k\, p(t - kT_b)$; $A_k = \pm 1$ Assuming $\tau = 2T_b$, find the value of the ISI term when the input bit sequence is a long string of alternating 0s and 1s. 	CO3	PO2	**08**
		c)	A binary wave using polar signaling is obtained by representing symbol 1 by a pulse of amplitude +1V and symbol 0 by a pulse of amplitude -1V. The duration of the pulse is T_b seconds. The binary wave is applied to a LPF having the transfer function H(f) = 1 / (1 + j (f/f_0)) Construct an Eye pattern for the following sequences assuming a bit rate of $2f_0$ bits/second: i. Alternating 0s and 1s ii. A long sequence of 1s followed by a long sequence of 0s	CO3	PO2	**06**

			iii. A long sequence of 1s followed by a single 0 and then a long sequence of 1s			
			UNIT - V			
	6	a)	State and prove the properties (Any Two) of the matched filter.	*CO2*	*PO1*	**06**
		b)	With relevant terminologies, derive the Probability of Error for the coherent detection of ASK.	*CO3*	*PO2*	**08**
		c)	A finite energy signal s(t) is given by: $s(t) = A \; ; \; 0 \le t \le T$ 0 ; Otherwise Determine the spectrum of the output of the filter matched to s(t)	*CO3*	*PO2*	**06**
			OR			
	7	a)	Consider the finite energy signal s(t) shown below. i. Sketch the impulse response hopt(t) of the optimum filter matched to signal s(t) ii. Determine the value of the output signal at t = T assuming zero noise and input as s(t)  	*CO2*	*PO1*	**06**
		b)	With relevant terminologies, derive the Power Spectral density for BPSK.	*CO3*	*PO2*	**08**
		c)	Calculate the probability of error for BFSK scheme employing coherent detection and ASK considering the data as follows: AWGN with power spectral density of 4 X 10^{-20} Watts/Hz, bit duration of 0.5μs, amplitude of received signal is 1.5μV.	*CO3*	*PO2*	**06**

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