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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

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

Branch: Electronics & Telecommunication Engineering. **Duration: 3 hrs.**

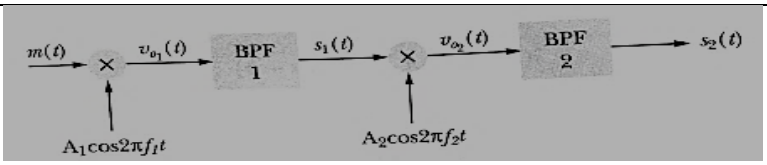
Course Code: 22ET4PCCS1 **Max Marks: 100**

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)	**Derive** the Expression of total transmission power and bandwidth for a typical AM signal. prove that efficiency of AM signal is 33.333%	*CO1, 2,3,4*	*PO 1,2*	**08**
	b)	What are modified forms of AM signals? With a neat circuit diagram, equation, and waveform, explain the operation of a ring modulator	*CO1, 2,3,4*	*PO 1,2*	**06**
	c)	Consider the message $m(t) = 20\cos(2\pi t)$ volts and the carrier wave $c(t) = 50\cos(100\pi t)$. (a) Give the time domain expression for the resulting AM wave for 75% modulation. (b) Find the power developed across a load of 100 ohm due to this AM wave (c) Required bandwidth	*CO1, 2,3,4*	*PO 1,2,*	**06**
		UNIT - II			
2	a)	With a neat block diagram and relevant equation explain Quadrature Amplitude Multiplexing	*CO1, 2,3,4*	*PO 1,2*	**08**
	b)	With the help of the amplitude response of the VSB filter, explain the VSB modulation and demodulation process.	*CO1, 2,3,4*	*PO 1,2*	**06**
	c)	Consider two stage SSB modulator shown in figure 2c. The input signal consists of voice signal occupying the frequency band 0.3-3.4KHz. The oscillator frequencies are f_1=100KHz and f_2=10MHz. Specify the following: (a) Sideband of DSB-SC modulated waves appearing at the two product modulator outputs (b) Side bands of SSB modulated waves appearing at two band pass filter outputs (c) Pass band and guard bands of Band pass filter.	*CO1, 2,3,4*	*PO 1,2*	**06**

			 Fig.2c			
			UNIT - III			
3	a)		Explain the generation of FM using the VCO method.	*CO1, 2,3,4*	*PO 1,2*	**06**
	b)		Explain the operation of PLL with the help of mathematical equations.(Non-linear model of PLL)	*CO1, 2,3,4*	*PO 1,2*	**08**
	c)		Given a single tone FM signal S(t)= 20 cos [$2\pi\ 10^6$t +2 sin $2\pi\ 10^4$t]. Sketch the FM spectrum for the carrier and first three sidebands. Assume $J_O(2)=0.224, J_1(2)=0.557$, $J_2(2)=0.353$, $J_3(2)=0.129$ respectively.	*CO1, 2,3,4*	*PO 1,2*	**06**
			OR			
4	a)		Describe with necessary equations and phasor diagram the generation of NBFM	*CO1, 2,3,4*	*PO 1,2*	**06**
	b)		Explain the noise in FM receivers and derive the expression for figure-of-merit of an FM receiver.	*CO1, 2,3,4*	*PO 1,2*	**08**
	c)		A single-tone FM signal is given by S(t) = 10 cos ($16\pi 10^6$ t + 20 sin $2\pi 10^3$ t). Determine i) Modulation index ii) Modulation frequency iii) Frequency deviation iv) Carrier frequency	*CO1, 2,3,4*	*PO 1,2*	**06**
			UNIT - IV			
5	a)		Explain the generation and reconstruction of a PCM signal with the help of a neat block diagram.	*CO1, 2,3,4*	*PO 1,2*	**06**
	b)		**Prove that** the output signal-to-noise ratio of a uniform Quantizer is $SNR_o = \left(\frac{3P}{m_{max}^2}\right) 2^{2R}$	*CO1, 2,3,4*	*PO 1,2*	**08**
	c)		Sketch Unipolar NRZ; polar NRZ; Manchester (split phase). For a bit sequence 010010110110.	*CO1, 2,3,4*	*PO 1,2*	**06**
			UNIT - V			
6	a)		Show how the mathematical representation of the energy of signals is justified with Gram-Schmidt's Orthogonalization procedure.	*CO1, 2,3,4*	*PO 1,2*	**08**
	b)		Explain the signal space representation for the ASK modulation technique. Also, derive the expression for the probability of error for the same.	*CO1, 2,3,4*	*PO 1,2*	**08**

		c)	Two functions s1(t) and s2(t) are defined below. $s1(t) = \begin{cases} A, & 0 \le t \le T \\ 0, & \text{elsewhere} \end{cases}$ $s2(t) = \begin{cases} 2A, & 0 \le t \le T/2 \\ 0, & \text{elsewhere} \end{cases}$ The interval is $0 \le t \le T$ seconds. Using the Gram-Schmidt procedure, express these functions in terms of orthonormal function. Also Sketch $\phi 1(t)$ and $\phi 2(t)$	*CO1, 2,3,4*	*PO 1,2*	**04**
			OR			
	7	a)	Explain the matched filter concept used for the receiver with relevant expression and also prove any two property of properties of the matched filter.	*CO1, 2,3,4*	*PO 1,2*	**08**
		b)	Explain the signal space representation for FSK modulation technique. Also derive the expression for the probability of error for the same.	*CO1, 2,3,4*	*PO 1,2*	**08**
		c)	Binary data are transmitted at a rate of 10^6 bps over a microwave link. Assuming channel noise AWGN with Zero mean and power spectral density at the receiver input, is 10^{-10} Watts/Hz. Find the average carrier power required to maintain an average probability of error Pe$\le 10^{-14}$ for coherent FSK. Determine the minimum channel bandwidth required. erfc(2.5)=4.1×10^{-3} , erfc(2.7) = 2×10^{-4}	*CO1, 2,3,4*	*PO 1,2*	**04**

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