FIRST INTERNAL ASSESSMENT

Sem: VI | **Sub:Digital Communication** | **Sub. Code: 15EC61**
Date: 05/03/2018 | **Time: 11:00am-12:00pm** | **Max. Marks:25**

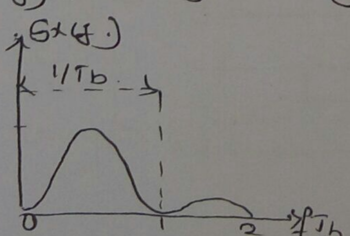
Note: Answer two full questions, draw sketches wherever necessary.

Q. No		Discription of Question	Marks	CO	RBT LEVEL
1	a	Define Hilbert transform.State and prove the properties of Hilbert Transform.	6	C301.1	L1,L2,L3
	b	Derive the power spectral density of Bipolar NRZ format.	6	C301.1	L1,L2,L3
		OR			
2	a	Expalin with the block diagram for generation of inphase and Quadrature phase components.	6	C301.1	L1,L2,L3
	b	For binary bit sequence 10110100,draw waveforms using i)Unipolar NRZ ii)Unipolar RZ iii)Polar NRZ iv)Bipolar NRZ	6	C301.1	L1,L2,L3
3	a	Explain the operation of Pre envelope for both negative and positive frequencies.	7	C301.1	L1,L2,L3
	b	Derive the power spectral density of Unipolar NRZ format.	6	C301.1	L1,L2,L3
		OR			
4	a	With block diagram, Explain the coherent binary PSK system.	7	C301.3	L1,L2,L3
	b	Obtain the expression for average probability of error calculation for PSK with coherent receiver.	6	C301.3	L1,L2,L3

Course Coordinator | **Module Coordinator** | **HOD**

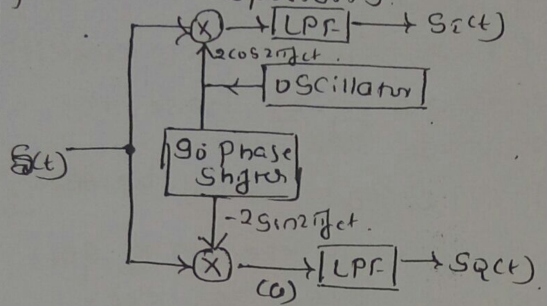
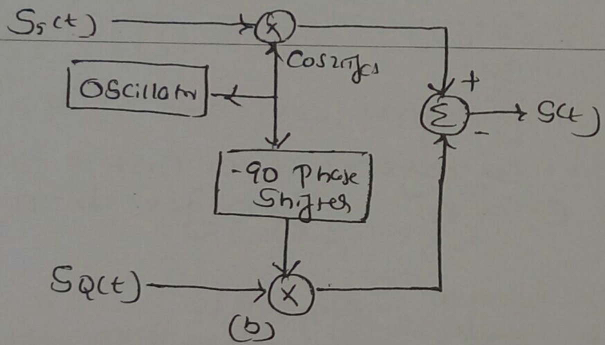
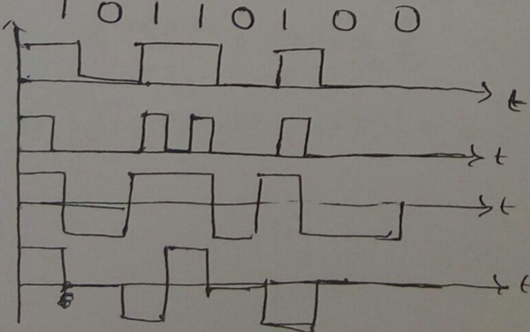
HOD
Electronics & Commn. [redacted]
HIT NIDASOSHI.

SCHEME OF EVALUATION

Sem : VI	Subject : Digital Communication		Sub Code : 15EC61	Date : 05/03/2018	
Q. No.	**Bit**	**Description**	**Marks**	**CO's**	**RBT LEVEL**
1)	a)	Hilbert Transform definition:- Phase angles of all the components are shifted by ±90°. →	½M		
		Properties:- ① A signal $g(t)$ and its Hilbert transform $\hat{g}(t)$ have the same magnitude spectrum. $\lvert G(f)\rvert = \lvert \hat{G}(f)\rvert$ with derivation →	1½M		
		Property ② If $\hat{g}(t)$ is the HT of $g(t)$, then the HT of $\hat{g}(t)$ is $-g(t)$. $\arg[G(f)] = -\arg[\hat{G}(f)]$ → with derivation	2M	C301.1	L1, L2, L3
		Property ③ A signal $g(t)$ and its HT $\hat{g}(t)$ are orthogonal over entire time interval $(-\infty, \infty)$. $\int_{-\infty}^{\infty} g(t)\,\hat{g}(t)\,dt = 0$ →	2M		
1)	b)	$A_k = \begin{cases} \pm a & \text{symbol '1'} \\ 0 & \text{symbol '0'} \end{cases}$ $P(A_k=0)=1/2$, $P(A_k=+a)=1/4$ & $P(A_k=-a)=1/4$ →	1M		
		$R_A(0) = \frac{a^2}{2}$, $R_A(-1) = R_A(1) = -\frac{a^2}{4}$, $R_A(2) = 0$ →	2M		
		∴ PSD of Bipolar NRZ $S_X(f) = \frac{1}{T_b}\lvert V(f)\rvert^2 \sum_{n=-\infty}^{\infty} R_A(n)\, e^{-j2\pi f n T_b}$		C301.1	L1, L2, L3
		$S_X(f) = a^2 T_b\, \text{sinc}^2(fT_b)\, \sin^2(\pi f T_b)$ → 	3M		

Staff-in-Charge Module Coordinator HOD

SCHEME OF EVALUATION

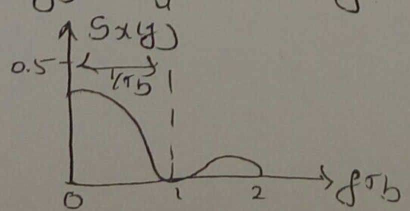
Sem : VI	Subject : DC	Sub Code : 15EC61	Date : 05/03/2018		
Q. No.	**Bit**	**Description**	**Marks**	**CO's**	**RBT LEVEL**
		OR			
2)	a)	Generation of inphase & Quadrature Phase Components.			
		 →	$1\frac{1}{2}$M		
		 →	$1\frac{1}{2}$M		
				C301.1	L1, L2, L3
		Explanation of each block diagram →	3M		
2)	b)			C301.1	L1, L2, L3
		Unipolar NRZ →	$1\frac{1}{2}$M		
		Unipolar RZ →	$1\frac{1}{2}$M		
		Polar NRZ →	$1\frac{1}{2}$M		
		Bipolar NRZ →	$1\frac{1}{2}$M		

S J P N Trust's
Hirasugar Institute of Technology, Nidasoshi.
Inculcating Values, Promoting Prosperity
Approved by AICTE, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi.

ECE Dept.
Exam.
IA Scheme Evaluation
Even Sem (2017-18)

SCHEME OF EVALUATION

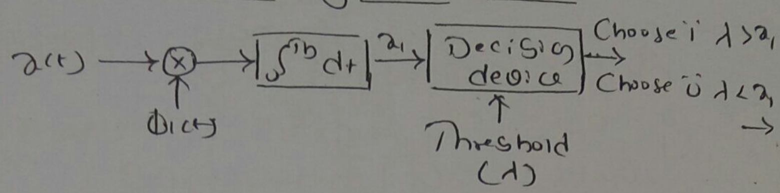
Sem : VI Subject : DC Sub Code : 15EC61 Date : 05/03/2018

Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
3)	a)	Operation of pre envelope → complex valued signal called the pre envelope of g(t), formally defined as $g_+(t) = g(t) + j\hat{g}(t)$. FT of above eq & for +ve frequencies $G_+(f) = G(f) + \mathrm{sgn}(f)G(f)$	→ 1M		
		$\therefore G_+(f) = \begin{cases} 2G(f) & f>0 \\ G(0) & f=0 \\ 0 & f<0 \end{cases}$	→ 3M	C301.1	L1, L2, L3
		For -ve frequencies:- $g_-(t) = g(t) - j\hat{g}(t)$; $G_-(f) = \begin{cases} 0 & ; f>0 \\ G(0) & ; f=0 \\ 2G(f) & ; f<0 \end{cases}$	→ 3M		
	b)	PSD of Unipolar NRZ format:- $A_k = \begin{cases} +a & \text{for symbol '1'} \\ 0 & \text{for symbol '0'} \end{cases}$ $P(A_k=0)=1/2$ & $P(A_k=0)=0$	→ 1M		
		$R_A(0) = a^2/2$ & $R_A(n) = a^2/4$	→ 2M		
		PSD derivation. $S_X(f) = \frac{a^2}{4} T_b \,\mathrm{sinc}^2(fT_b) + \frac{a^2}{4}\delta(f)$ 	→ 3M	C301.1	L1, L2, L3

Staff-In-Charge Module Coordinator HOD

SCHEME OF EVALUATION

Sem : VI	Subject : DC	Sub Code : 15EC61	Date : 05/03/2018

Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
		OR			
4)	a)	Coherent binary PSK Sim.			
			2M		
		Explanation of the above block	2M	C301.3	L1, L2, L3
		Calculate the threshold value i.e $\lambda = 0$	2M		
4)	b)	Probability error calculation of BPSK-			
		$x(t) = s(t) + w(t)$			
		$x(t) = \begin{cases} s_1(t) = \sqrt{E_b}\,\phi_1(t) + w(t) & \text{symbol 1} \\ s_2(t) = -\sqrt{E_b}\,\phi_1(t) + w(t) & \text{symbol 0} \end{cases}$			
		$f_{x_1}(x_1/0) = \frac{1}{\sqrt{\pi N_0}} e^{-\left[\frac{x_1+\sqrt{E_b}}{\sqrt{N_0}}\right]^2}$	2M		
		$P_e(0) = \frac{1}{2} erfc\left(\sqrt{\frac{E_b}{N_0}}\right)$	2M		
		$P_e(1) = \frac{1}{2} erfc\left(\sqrt{\frac{E_b}{N_0}}\right)$	1M		
		$P_e = \frac{1}{2} erfc\left(\sqrt{E_b/N_0}\right)$	1M	C301.3	L1, L2, L3

Staff-In-Charge Module Coordinator HOD