DELHI TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION DEPPT.

Sem – IV

MID SEMESTER EXAMINATION March - 2019

Paper Code: EC 206 **Communication Systems**

Time : 1 hr 30 m *Max Marks : 20*

Note : Answer all the questions.
Assume suitable missing data if any.
Use of Scientific Calculator is permitted.

Q. 1 [2+3]

a) Find the convolution of two signals

$s_1(t) = \text{rect}\left(\frac{t}{T}\right)$ and $s_2(t) = e^{-t}\,u(t)$

b) Show that Hilbert transform of the signal s (t) = rect (t/T) in given by $(1/\pi)\ \ln|(2t+T)/(2t-T)|$

Q. 2 [2+3]

a) Given FM and PM modulators with the following specifications

FM modulator	**PM modulator**
Deviation sensitivity K_F= 1.5 KHz/v	K_P = 0.75 rad/v
Carrier frequency f_c= 500 KHz	f_c= 500 KHz
Modulating signal $m(t) = 2\,\text{Sin}(2\pi.2\text{x}10^3 t)$	$m(t) = 2\,\text{Sin}(2\pi.2\text{x}10^3 t)$

i) Determine the modulation index and sketch the output spectrums for both modulators.

ii) Change the modulating signal amplitude for both modulators to $4V_P$ and repeat (i)

iii) Change the modulating signal frequency for both the modulators to 1 KHz and repeat (i). From the above results comment on the spectrums of FM & PM.

Given

$J_0(1.5)$= 0.5118	$J_1(1.5)$= .5579	$J_2(1.5)$= .2321	$J_3(1.5)$= .0610
$J_4(1.5)$= 0.0118	$J_5(1.5)$= .0018	$J_6(1.5)$= .0002	$J_7(1.5)$= .0000
$J_0(3)$= -.26	$J_1(3)$= .34	$J_2(3)$= .48	$J_3(3)$= .31
$J_4(3)$= .13	$J_5(3)$= .04	$J_6(3)$= .01	$J_7(3)$= .002

P.T.O.

Q.2

b) A modulating signal m (t) which is band limited up to W Hz is signal sideband modulated using a carrier signal $A_c\cos\omega_e t$. Find the expressions for upper side band $u_{ussb}(t)$ and lower sideband $u_{lssb}(t)$. Suggest a scheme to generate $u_{ussb}(t)$. Show that $u_{ussb}(t)$ have both Amplitude modulation (AM) and phase modulation (PM).

Q.3 [3+2]

a) How varacter diode can be used for FM modulation? Explain with a practical circuit. How balanced Discriminator can be used for FM demodulation? Give all the mathematical justifications.

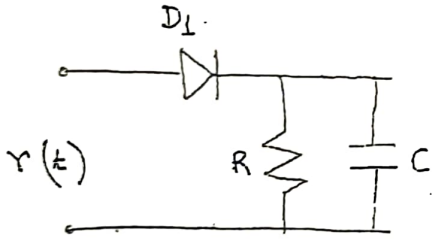
b) How AM modulated signals can be generated by means of switching modulator?

Q.4 [2+3]

a) The received AM signal in absence of noise is given by

$r(t) = A_c[1+am_n(t)]\cos 2\pi f_c t$.

Where $m_n(t)$ is the normalized message signal with bandwidth W is applied to the input of the demodulator circuit given below.



Determine the upper limit of RC to ensure that the capacitor voltage follows the envelope.

Q. 4

b) Derive the condition that must be satisfied by VSB filter in VSB modulator.