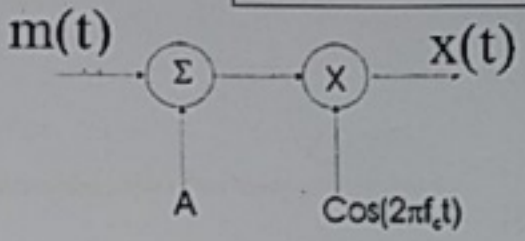
Answer **ALL** questions

Question 1 [15 marks]

1) Consider the following modulation system

If $m(t)=2\cos(20\pi t)$ is transmitted using this modulation system with $f_c = 500Hz$



a) Assume that A=2.

I. What type of modulation does this correspond to? [2]

II. Sketch the output signal x(t). [2]

III. .Sketch the spectrum of the output signal. [2]

b) Assume that A=0

I. What type of modulation does this correspond to? [2]

II. Sketch the spectrum of the output signal x(t). [2]

III. How would you modify the given modulation system such that the output signal is $x(t)=\cos(980\pi t)$? [2]

2) Arrange VSB, SSB, DSB-SC, AM and wideband FM in the decreasing order of the bandwidth required for transmission. [3]

Question 2 [13 marks]

1) Draw the block diagram of NBPM generation system. [3]

2) From the following figure:
a) Determine y(t). [3]

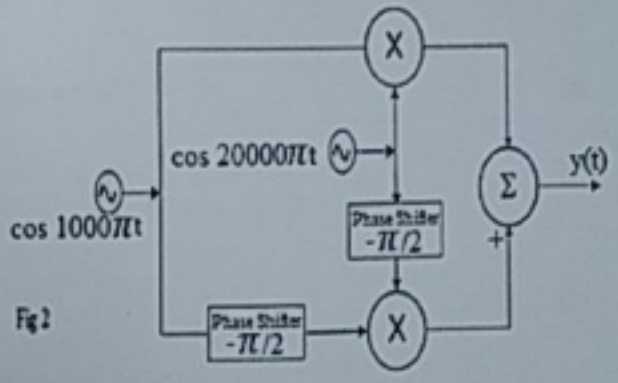


Fig2

b) Determine the type of modulation (Be specific). [2]

3) An AM signal of the form $x(t)= Ac[1+A\cos(2\pi f_m t+ \pi/3)]\cos 2\pi f_c t$ contains a total power of 1000W and the modulation index is 0.8.

a) Calculate the power contained in the carrier and the sidebands. [3]

b) Calculate the efficiency. [2]

Question 3 [12 marks]

1) A FM modulator is used to transmit a tone message with amplitude of 4 volts and frequency of 20Hz. The frequency deviation constant for modulator (K_f) is 25 Hz/V. The carrier wave has amplitude 10volts and frequency 2000Hz.

a. What is the power of the FM modulated signal. [2]

b. What is the Bandwidth of the FM modulated signal (use Carson's rule). [2]

c. Is this NBPM or WBPM? Explain your answer. [2]

d. If the output of the FM modulator is passed through a band bass filter has a centre frequency of 2000Hz and bandwidth of 130 Hz, plot the spectrum of the filter output. [4]

e. How would your answer to part (2) changed if the frequency of the carrier is doubled. [2]

Notes:

- $\cos(x+y) = \cos(x).\cos(y) - \sin(x).\sin(y)$ $\cos(x-y) = \cos(x).\cos(y) + \sin(x).\sin(y)$
- Table of Bessel function

β / n	$\beta=1$	$\beta=2$	$\beta=3$	$\beta=4$	$\beta=5$	$\beta=6$
$n=0$	0.7652	0.2239	0.2601	0.3971	-0.1776	0.1506
$n=1$	0.4401	0.5767	0.3391	0.0660	-0.3276	-0.2767
$n=2$	0.1149	0.3528	0.4861	0.3641	0.0466	-0.2429
$n=3$	0.0196	0.1289	0.3091	0.4302	0.3648	0.1148
$n=4$	0.0025	0.0340	0.1320	0.2811	0.3912	0.3576
$n=5$	0.0002	0.0070	0.0430	0.1321	0.2611	0.3621
$n=6$	0.0000	0.0012	0.0114	0.0491	0.1310	0.2458
$n=7$	0.0000	0.0002	0.0025	0.0152	0.0534	0.1296