

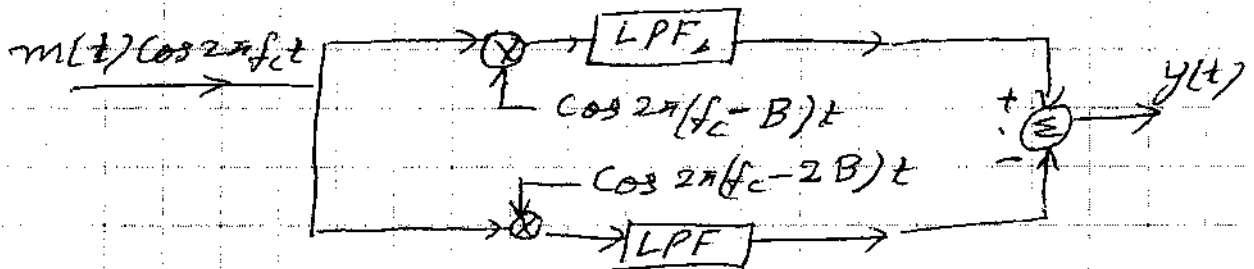
INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date: 21/10 FN/AN Time: 2/3 Hrs. Full Marks 30 No. of Students 90/2
 Autumn / Spring Semester: 2010 Deptt.: E&ECE Sub. No. EC31001
 Yr. B.Tech. (H) / B.Arch. (H) / M.Sc. Sub. Name Analog Communication
 Instruction: Answer all questions. All questions carry equal Marks.

- 1 (a) Find the Fourier series representation for a rectifier that rectifies a sinusoidal signal of frequency f_c .
- (b) Prove that Fourier transform of $\frac{1}{\pi t}$ is $-j \operatorname{sgn}(f)$.

2 (a) Describe, with the help of a block diagram, generation of DSB/SC waveform. How can the carrier be recovered in such a case?

(b) For a DSB/SC signal as shown, if Fig 2(b) is used, find the output spectrum and its representation in time domain.



Consider bandwidth of $m(t) = B$, $f_c > 4B$,
 3dB cut off of each LPF = $3B$.

3 (a) With the help of phasor diagram describe the difference between narrowband FM and DSB with carrier signal.

- 3 (b) Describe the function of a frequency discriminator with the help of a block diagram. Also give a circuit diagram for implementing the FM demodulation.
- 4 (a) Show that the real part and imaginary part of a complex bandpass signal are related to each other by Hilbert transform.
- (b) Prove that bandpass filter at centre frequency f_c represents a matched filter for the transmitted carrier with narrowband modulation.
- 5 (a) Evaluate the SNR gains for (i) DSB/SC (ii) SSB and (iii) AM with envelope detection in the presence of additive white Gaussian noise.
- (b) Show that for an AWGN ^{passband} modelled as narrowband the baseband components, in phase and quadrature both, will have twice the magnitude of narrow power spectral density.