

2014

M.Sc.

3rd Semester Examination

ELECTRONICS

PAPER—ELC-303

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Communication Engineering)

Answer Q. No. 1 and any three questions from the rest.

1. Answer $\frac{1}{4}$ questions : $\frac{1}{5}$ 2×5

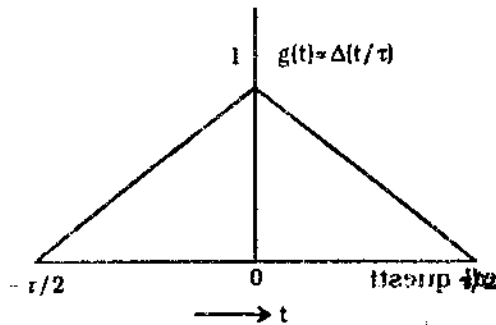
- (a) Discuss different merits and demerits of differential PCM over delta modulation.
- (b) For an AM System prove that

$$P_t = P_c \left(1 + \frac{m^2}{2} \right);$$

where P_t is the total power, m the molecular index and P_c the power of the carrier signal.

(Turn Over)

- (c) Find the inverse Fourier transform of $\delta(f - f_0)$.
- (d) Show that FM wave has been non-linear noise in comparison with AM wave.
- (e) Discuss the phase-shift method to generate SSB signal.
2. (a) If 'x' input is applied to a system 'h' showing output 'y', then determine the transfer function $H(f)$ of the system for distortions condition.
- (b) Use time differentiation property to find the Fourier transform of the triangular pulse $\Delta(t/\tau)$ shown below :



- (c) Write down the conditions for distortionless transmission LTI system. 4+4+2

3. (a) With a neat diagram describe the principle of operation of a ring modulator to generate DSB-SC AM wave.
- (b) How can you convert the carrier frequency of a DSB-SC signal using a frequency mixer?
- (c) Discuss the process of coherent demodulation of a DSB-SC signal. 4+3+3

4. (a) If $H_1(f)$ is the transfer function of a vestigial shaping filter and $H_0(f)$ is the low-pass equalizer filter of a USB system, then prove that :

$$H_0(f) = \frac{1}{H_1(f+f_c) + H_1(f-f_c)}$$

- (b) The antenna current of an AM transmitter is 8A when only the carrier is sent, but it increases to 8.93A when the carrier is modulated by a single sine wave. Find the percentage modulation.
- (c) With a neat sketch discuss the principle of operation of an envelope detector. 4+3+3
5. (a) An angle-modulated signal with carrier frequency $\omega_c = 2\pi \times 10^5$ is described by the equation

$$\phi_{EM}(t) = 10 \cos \{ \omega_c t + 5 \sin 3000t + 10 \sin 2000\pi t \}$$
 Find the frequency deviation Δf and deviation ratio β .
- (b) How can you demodulate FM signal using a slope detection method?
- (c) With a neat sketch discuss the indirect method of Armstrong to generate WBFM. 3+3+4

6. (a) State and prove the sampling theorem.
 (b) Derive the interpolation formula

$$g(t) = \sum_k g(kT_s) \text{Sinc}(2\pi Bt - kT_s)$$

where the symbols have their usual meaning.

- (c) For a PCM system prove that

$$\frac{S_0}{N_0} = 3L^2 \frac{m^2(t)}{m_p^2}$$

where L is the number of Granter levels, S_0/N_0 is the signal to noise ratio, $m^2(t)$ is message signal and m_p is the peak amplitude value that a quantizer can accept. 4+2+4

[Internal Assessment — 10]
