53 (IE 603) CMEN

2017

COMMUNICATION ENGINEERING

Paper : IE 603

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Differentiate the following : 2+2=4

   (i) Analog Communication and Digital Communication

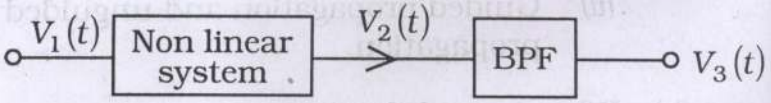
   (ii) Guided propagation and unguided propagation.

   (b) What is modulation ? What is the need for modulation ? 1+3=4

(c) Determine the per cent modulation of an amplitude-modulated wave which has a power content at the carrier of $10kW$ and $4kW$ in each of its sidebands when the carrier is modulated by a simple audio tone. 2

(d) Explain with a neat circuit diagram the working of Square law diode modulation. Obtain an expression for its output. 6

(e) Derive an expression for the signal $V_3(t)$ in figure for $V_1(t) = 10cos(1800\pi t) + 4sin(600\pi t)$.. Assume that $V_2(t) = V_1(t) + 0{\cdot}16V_1^2(t)$ and that the BPF is an ideal unity gain filter with passband from $600Hz$ to $1200Hz$. 3



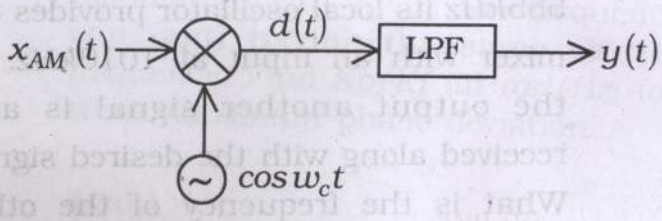
(f) What is the condition for critical modulation? 1

2. *(a)* Draw frequency spectrum of DSB-SC, SSB-SC and VSB signal. 6

(b) With the help of neat block diagram and waveform explain Ring modulator. 5

(c) Explain how, diode can extract the envelope of an AM wave. 6

(d) Show that a synchronous demodulator shown in figure can demodulate an AM signal $x_{AM}(t) = [A + m(t)] \cos w_c t$ regardless of the value A. 3



3. *(a)* What is the difference between low-level and high-level AM transmitters ? 2

(b) The antenna current of an AM transmitter is 8*A*, if only the carrier is sent, but it increases to 8·95*A*, if the carrier is modulated by a single sinusoidal wave. Determine the percentage modulation. Also find the antenna current if the per cent of modulation changes to 0·8. 5

(c) Write the main functions of a radio receiver. 3

(d) Explain in brief the block diagram of superheterodyne receiver. 8

(e) When a radio receiver is tuned to 555*kHz* its local oscillator provides the mixer with an input at 1010*kHz*. At the output another signal is also received along with the desired signal. What is the frequency of the other station ? 2

4. (a) Derive the general expression for FM wave. 6

(b) What is single tone frequency modulation? A single tone FM is represented by the voltage equation as

$$V(t) = 15\cos(6000t + 5\sin 950t)$$

Determine : (i) Carrier frequency

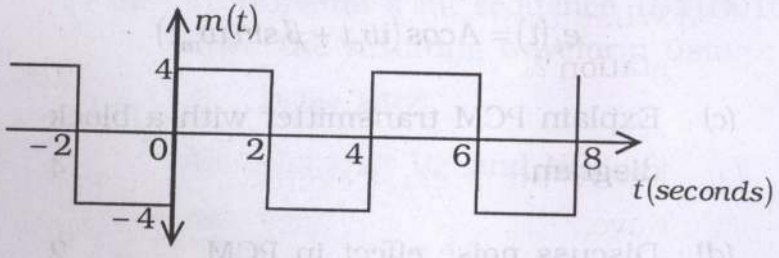
(ii) Modulating frequency

(iii) Maximum deviation

(iv) What power will this FM wave dissipate in 10Ω resistor? 5

(c) What is Carson's rule? 1

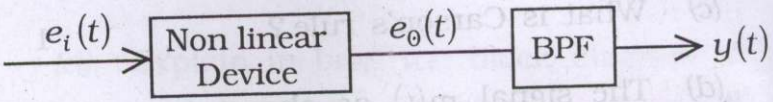
(d) The signal $m(t)$ as shown is applied both to a phase modulator (with Kp as the phase constant) and a frequency modulator (with Kf as the frequency constant) having the same carrier frequency. Find Kp/Kf (in rad/Hz) for same maximum phase deviation. 4



(e) Explain the indirect method of FM generation. 4

5. (a) What is balanced slope detector in FM demodulation? Also give its disadvantages. 5+2=7

(b) The frequency multiplier is a nonlinear device followed by a BPF. 3



The nonlinear device is an ideal square law device with input output characteristics $e_0(t) = ae_i^2(t)$. Determine the output $y(t)$ if the input is an FM signal given by —

$$e_i(t) = A\cos(w_c t + \beta \sin w_m t)$$

(c) Explain PCM transmitter with a block diagram. 4

(d) Discuss noise effect in PCM. 2

(e) In a binary PCM system, the output signal to quantizing noise ratio is to be held to a minimum value of 40*dB*. Determine the number of required levels, and find the corresponding output signal to quantizing noise ratio. 4

6. (a) Explain laws of Kepler that govern the motion of a planet and other heavenly bodies. 4

(b) Explain the functional block diagram of monochrome TV transmitter. 6

(c) Name different types of optical fibres. Explain how light propagate through optical fibre. 1+4=5

(d) To transmit a bit sequence 10110010, draw the resulting waveform using :

(i) Polar NRZ

(ii) Unipolar RZ and NRZ

(iii) AMI

(iv) Manchester. 5

7. Write short notes on : 5×4=20

(i) Delta modulation

(ii) PLL FM Demodulator

(iii) Crystal Filter

(iv) Quantization

(v) Narrowband FM.