DMM-1620
M. Sc. (Sem. IV) Examination
April/May - 2016
PH(E) - 544 : Physics - Electronics
(Electronic Communication)

Time : 3 Hours] [Total Marks : 70

Instructions :

(1) Fillup strictly the details of signs on your answer book.

Name of the Examination :
M. Sc. (Sem. IV)

Name of the Subject :
PH(E) - 544 : Physics - Electronics (Electronic Communication)

Subject Code No. : 1 6 2 0 Section No. (1, 2, .......) Nil

Seat No. :

(2) Assume the data if required.
(3) Figures to right hand side indicate marks of each question.
(4) Attempt any two of each question.

1 (a)  (i) Explain the sampling function and show that

\[ S_2[\pm(n+\frac{1}{2})] = \frac{2(-1)^n}{(2n+1)\pi} \]

(ii) A periodic triangular waveform \( v(t) \) is defined by

\[ v(t) = \frac{2t}{T} \quad \frac{-T}{2} < t < \frac{T}{2} \] has the fourier expansion

\[ v(t) = \frac{2}{\pi} \sum_{n=1}^{\infty} \left(-1\right)^n \frac{\sin \frac{2\pi nt}{T}}{n} \]

Calculate the fraction of the normalized power of this waveform which is contained in its first four harmonics.

2 (b) (i) Prove that convolution in the frequency domain is equivalent to multiplication in the time domain.

(ii) Discuss the effect of transfer function on the power spectral density. Derive the relation between input power spectral density and output power spectral density.

2 (c) (i) What is the need for modulation in a communication system?

(ii) Evaluate the following convolution integral

\[ V_1(t) = e^{at} u(t) \]

\[ V_2(t) = u(t) \]

Where \( u(t) \) is the unit step function.

3
2 (a) Describe the methods of generating SSB signals.

(b) What is vestigial sideband modulation? How is it obtained? What are the advantages of it? Why is it used for commercial television broadcasting?

(c) Describe the methods for generation of DSB-SC signals.

3 (a) Draw the block diagram of stereophonic FM broadcasting transmitter and receiver system and explain the operation of it.

(b) What is the importance of second order Phase locked loop. Explain the operation of it with block diagram.

(c) (i) An FM wave is represented by the voltage equation \( v(t) = 16 \sin(4 \times 10^3 t + 6 \sin 2000t) \). Find the carrier and modulating frequencies, the modulation index and the maximum frequency deviation of the FM. What power will the FM voltage dissipate in a 12 \( \Omega \) resistor?

(ii) What are the disadvantages of FM over AM?

4 (a) Show that in a parallel tuned circuit, the equivalent parallel impedance at resonance equals its equivalent resistance for noise generation.

(b) (a) In a multistage amplifier, derive the expression for net equivalent noise resistance in terms of resistance \( R_1, R_2, R_3 \) etc. at the input of first, second and third stages respectively and the voltage gain of individual stages.

(b) The noise output of a resistor is amplified by a noiseless amplifier having gain of 40 and bandwidth of 40 KHz. A meter connected to output of the amplifier reads 4 mv rms. (i) If the resistor is operated at 27°C, what is its resistance? (ii) If the bandwidth of the amplifier is reduced to 10 KHz, its gain remaining constant, what will be meter read now?

(c) (i) The first stage of a two stage amplifier has output resistance of 25 K\( \Omega \), voltage gain of 12, input resistance of 600\( \Omega \) and equivalent noise resistance of 2400\( \Omega \). The second stage has output resistance of 300 K\( \Omega \), voltage gain of 25, input resistance of 100 K\( \Omega \) and equivalent noise resistance of 8 K\( \Omega \). The amplifier is driven by a generator of output resistance 50 \( \Omega \). Compute for this two stage amplifier:

- equivalent input noise resistance
- equivalent input noise voltage given that the bandwidth of the amplifier is 10KHz and the ambient temperature is 330 K.

- noise figure of the complete system.

(ii) Compute the noise voltage at the input of a video amplifier using a device having 300 \( \Omega \) equivalent noise resistance and 400 \( \Omega \) input resistor. The bandwidth of the amplifier is 7 MHz and the ambient temperature is 27°C.

5 (a) Explain Preemphasis and deemphasis in commercial FM broadcasting. Draw the Preemphasis and deemphasis network used in commercial radio.

(b) (i) Discuss different forms of pulse modulation.

(ii) Explain the time division multiplexing of two pulse amplitude modulated signals.

(c) State and prove the sampling theorem and explain its importance in pulse communication system.

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Use the following data if required:

- \( K_B = 1.38 \times 10^{-23} \text{ J/}^0\text{K} \)
- \( h=6.62 \times 10^{-34} \text{ J.sec} \)
- \( E = 9.1 \times 10^{-31} \text{ Kg} \)
- \( C = 3 \times 10^8 \text{ m/sec} \)
- \( 1 \text{ eV} = 1.6 \times 10^{-19} \text{ Joule} \)