

B.Tech 6th Semester Exam., 2015

INTRODUCTION TO COMMUNICATION SYSTEMS

Full Marks : 70

Time : 3 hours

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct option/Answer the following (any seven) : 2×7=14

(a) The highest modulating frequency used in AM broadcast system is

(i) 10 kHz

(ii) 15 kHz

(iii) 5 kHz

(iv) 2 MHz

(b) Radio signals are made up of

(i) voltages and currents

(ii) electric and magnetic fields

(iii) electrons and protons

(iv) noise and data

6. (a) Explain the generation and detection of a PWM signal. 7
- (b) Compare among PAM, PWM and PPM systems. 7
7. (a) Draw the block diagram of a super-heterodyne receiver and explain the function of each block. 7
- (b) Define the following for a receiver : 7
- (i) Sensitivity
 - (ii) Selectivity
 - (iii) Fidelity
 - (iv) Tracking
 - (v) Double spotting
 - (vi) Image frequency and its rejection
8. (a) Evaluate the noise performance of FM system. 7
- (b) Evaluate the figure of merit of an AM receiver operating on single-tone AM. 7
9. (a) Sketch the composite video signal waveform for three lines and explain various components in brief. 7
- (b) Draw the block diagram of a monochrome TV transmitter and describe each block in brief. 7

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(c) The Fourier transform of convolution of signals in the time domain will be transformed into the — of their Fourier transforms in the frequency domain.

- (i) addition
- (ii) subtraction
- (iii) division
- ☒ (iv) multiplication

(d) The trigonometric Fourier series of a periodic time function can have only — term(s).

- (i) d.c. and cosine
- (ii) cosine
- ☒ (iii) sine
- (iv) sine and cosine

(e) In AM

- (i) sideband power is always constant
- (ii) total transmitted power is constant
- ☒ (iii) carrier power is constant
- (iv) bandwidth is infinite

(Continued)

(f) With increase in the modulation index of an FM wave, the number of sidebands having significant amplitude

- (i) will increase
- (ii) will decrease
- ☒ (iii) remains constant

(g) The frequency deviation in PM is proportional to

- (i) modulating voltage
- ☒ (ii) modulating frequency
- (iii) modulating frequency and voltage

(h) In FM, when the modulating frequency is 1000 Hz and AF voltage is 2 V, the deviation is 4 kHz. If the modulating voltage is increased to 3 V, the new deviation is given by

- (i) 4 kHz
- (ii) 2 kHz
- ☒ (iii) 6 kHz
- (iv) 10 kHz

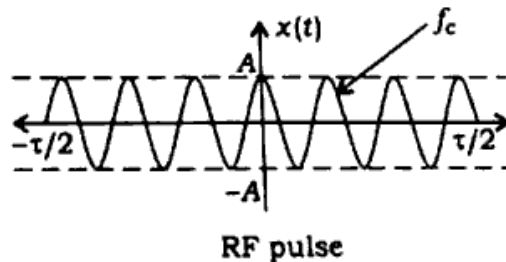
- (i) The noise immunity of PAM signal is
- better than PWM and PPM
 - better than PWM but worse than PPM
 - poorer than PWM as well as PPM

- (j) Write the advantage of super-heterodyning.

2. (a) Write down the trigonometric form of the Fourier series representation of a periodic signal. State the necessary and sufficient conditions for the existence of the Fourier series representation for a signal.

- (b) Find the PSD for $x(t) = A \cos(2\pi f_c t)$ and hence find the average power of the signal $x(t)$.

3. (a) Obtain the Fourier transform and amplitude spectrum of the RF pulse shown in the figure below :



- (b) Define amplitude modulation. Derive the relationship between the total transmitted power and carrier power in an AM system when several frequencies simultaneously modulate a carrier.

4. (a) Show that if the output of a phase-shift modulator is an SSB signal, (i) the difference of the signals at the summing junction produces the upper-sideband SSB signal and (ii) the sum produces the lower-sideband SSB signal. That is

$$x_c(t) = x_{\text{USB}}(t) = m(t) \cos \omega_c t - \hat{m}(t) \sin \omega_c t$$

is an upper-sideband SSB signal and

$$x_c(t) = x_{\text{LSB}}(t) = m(t) \cos \omega_c t + \hat{m}(t) \sin \omega_c t$$

is a lower-sideband SSB signal.

- (b) What is DSB-SC modulator? Explain how the ring modulator for generation of DSB-SC wave acts as a demodulator.

5. (a) Compare between wideband FM and narrowband FM. Use Carson's rule to compare the bandwidth that would be required to transmit a baseband signal with frequency range from 300 Hz to 3 kHz using (i) NBFM with maximum deviation of 5 kHz and (ii) WBFM with maximum deviation of 75 kHz.

- (b) Draw the circuit diagram of balanced slope detector and explain it for demodulation of FM signal.