

M.Sc. (Informatics)/I- Sem. - 2012

Paper : IT-13

INTRODUCTION TO COMMUNICATION AND SYSTEMS

Time: 3 hours

Maximum Marks: 75

(Write your Roll No. on the top immediately on receipt of this question paper)

Attempt five questions in all. Q.1 is compulsory

Q.1(a) Draw the output of a half-wave rectifier. Obtain its trigonometric Fourier Series representation. (7)

(b) The equation for a gate function may be written as: (5)

$$x(t) = \text{rect}\left(\frac{t}{\tau}\right)$$

Find the Fourier transform of the gate function.

(c) Define a unit impulse function. Find the Fourier transform of an impulse function and draw its spectrum. (3)

Q.2(a) If the fourier transform of a signal $x(t)$ is $X(f)$ which may be written as: $x(t) \rightarrow X(\omega)$, then find the Fourier transform of $x(at)$. (5)

(b) Show that $\frac{dx(t)}{dt} \rightarrow j\omega.X(\omega)$. (5)

(d) Draw the circuit diagram of a low-pass RC-network. For this network , find the output or response if the input signal is $x(t) = \exp\left(\frac{-t}{RC}\right)$. (5)

Q.3(a) Using the time convolution property, show that if

$$g(t) \rightarrow G(\omega)$$

$$\int_{-\infty}^t g(\tau) d\tau \rightarrow \frac{G(\omega)}{j\omega} + \pi G(0)\delta(\omega)$$

(5)

(b) Discuss the time-domain and frequency-domain description of amplitude modulation(AM). In a single tone amplitude modulation, find the amplitudes and frequencies for various components in its spectrum. (6)

(c) The tuned-circuit of the oscillator in an AM transmitter uses a $50\mu H$ coil and a $1nF$ capacitor. Now , if the oscillator output is modulated by audio frequencies upto $8kHz$, then find the frequency range occupied by the sidebands. (4)

Q.4(a) Explain ,with the help of schematic diagram, the generation and detection of DSBSC modulated wave. What do you understand by the quadrature-carrier multiplexing scheme. (6)

(b) Explain the generation and detection of single side band suppressed carrier (SSBSC) signal. (6)

(c) Which of the following demodulators can be used and why for demodulating the signal (3)

$$x(t) = 5 [1 + 2 \cos(20000\pi t)] \cos(2000\pi t)$$

(i) Envelop demodulator

(ii) Square-law demodulator

(iii) Synchronous demodulator

(iv) None of the above .

Q.5(a)Distinguish between the *frequency* and *phase modulation*. Define the modulation index m_f in Frequency modulation (FM) and hence discuss the effect of variation of m_f on the spectrum of FM signal. (6)

(b) Describe a method for FM generation and FM demodulation. (5)

(c) A $100MHz$ carrier wave has a peak of 5volts. The carrier is frequency modulated (FM) by a sinusoidal modulating signal or waveform of frequency $2kHz$ such that the frequency deviation is $75kHz$. The modulated waveform passes through zero and is increasing at $t = 0$. Determine the expression for the modulated carrier waveform. (4)

Q.6(a) List the types of digital modulation techniques.How does the *ASK* signal generated? Describe the coherent demodulation of binary *ASK* signal. (6)

(b) What do you understand by (i) Pulse amplitude, (ii) pulse time ,(iii) pulse width and (iv) pulse position modulation. (6)

(c) Describe the spectral representation of pulse duration modulation (PDM) and pulse position modulation (PPM) waves. (3)