Subject: ANALOG COMMUNICATIONS

Time: 3 Hours

JUNE 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 **Choose the correct or the best alternative in the following:** (2×10)

a. If f_{max} is the maximum modulating frequency and f_c is the carrier frequency then a simple amplitude modulated spectrum has a bandwidth of :

    (A) f_{max} **(B)** $f_c + f_{max}$

    (C) $f_c - f_{max}$ **(D)** $f_c \pm f_{max}$

b. The receiver system noise power can be reduced by:

    (A) Using a high gain antenna   **(B)** Using an LNA

    (C) Reducing the bandwidth of the   **(D)** Using a long feeder line

         Receiver IF amplifier

c. A DSBSC modulation saves:

    (A) Bandwidth as compared to AMDSB.

    (B) Power as compared to AMDSB.

    (C) System hardware as compared to AMDBS.

    (D) Delay as compared to AMDSB.

d. Frequency modulation is normally associated with:

    (A) Amplitude modulation   **(B)** Phase modulation

    (C) Pulse modulation   **(D)** Frequency delay

e. Selectivity of a receiver is decided by:

    (A) Antenna   **(B)** Mixer

    (C) IF amplifier   **(D)** Demodulator

f. The amplitude variations in the carrier is taken care of in the receiver by:

    (A) Demodulator   **(B)** De-emphasis

    (C) Limiter   **(D)** IF amplifier

g. Signal is recovered in SSB receiver by:

   (A) Envelop detector   **(B)** Ratio detector
   (C) Phase Lock Loop   **(D)** Ring detector

h. Characteristic impedance of a transmission line is given by:

   (A) $\sqrt{(L/C)}$ **(B)** $\sqrt{(Z_L/Z_C)}$
   (C) $\sqrt{(C/L)}$ **(D)** $\sqrt{(\omega L/C)}$

i. When a transmission channel is matched to the source and load there is:

   (A) No delay
   (B) Maximum power transfer
   (C) Maximum voltage appears across load
   (D) There is no change in frequency

j. Multiplexing is a process of:

   (A) Building a base band.   **(B)** Modulation.
   (C) Accessing a common resource   **(D)** Adding signals

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. With the help of a neat diagram explain the concept of communication system. Explain the importance of each block. **(8)**

   b. What are the various sources of noise, how noise affects the overall performance of a communication system. **(4)**

   c. Calculate the system noise of a receiver that has three stages of a receiver having overall gain of 40dB and bandwidth of 30 KHz. The noise figures is 7dB. Assume $T_o = 290^\circ K$ and Boltzmann's constant $1.38 \times 10^{-23} \, J/^\circ K$. **(4)**

Q.3 a. How amplitude modulation is achieved, what are the methods used for side bands suppression. **(10)**

   b. A signal $v(t) = 100 \sin(630t)$ modulates a Carrier of $e(t) = 50 \cos(100 \times 10^3 t + 90)$, the output is an AM signal, find the carrier frequency, side band frequencies, power in carrier and side bands if load impedance is 100 ohms. **(6)**

Q.4 a. Justify the statement 'FM has infinite bands'. Calculate the bandwidth of an FM signal generated to have a deviation of 75 KHz by a message signal of 9 KHz. What is the modulation index of the FM wave? **(6)**

   b. Show how FM is generated from PM? What is this method called? **(6)**

c. Explain the need for pre-emphasis in FM. How is it implemented? **(4)**

Q.5 a. What is the need of the following in a radio receiver, explain giving examples:
(i) AGC   (ii) Mixer
(iii) Intermediate amplifier **(6)**

b. Explain the principle of a phase discriminator, how does it reproduce the time varying message? **(6)**

c. What is a product demodulator, where is it used, explain its principal of working. **(4)**

Q.6 a. What are balanced and unbalanced transmission lines? A coaxial transmission line has an inner copper conductor of 0.58 mm diameter and outer conductor of 3.77 mm diameter. These are separated by on dielectric having a dielectric constant of 2.23. Calculate the characteristic impedance and inductance/m if the lumped capacitance is 65pf. **(6)**

b. Explain the various losses that occur in a transmission line. Explain the principle of a quarter wave line in eliminating standing waves. **(6)**

c. What is the need of a direction coupler, explain its principle. **(4)**

Q.7 a. What are the frequency limitations of a wave guide on what factors do these depend. Calculate the minimum frequency that can be transmitted through an rectangular wave guide in TM_{11} mode, having a = 2.5cm, b = 2 cm. **(6)**

b. Explain the usefulness and principle of operation of a cavity resonator. **(4)**

c. Write short notes on:
(i) Magic Tee   (ii) Circulator. **(6)**

Q.8 a. What is Shannon's limit theorem, what do you interpret from this theorem. Calculate the Bandwidth requirement for a stream of NRZ data received at 64 Kbps with an SNR of 12 dB. **(8)**

b. What are the different techniques used to convert analog signal in to pulses. Briefly explain each one of these. **(8)**

Q.9 a. It is proposed to transmit 120 voice channels on a single carrier, suggest a scheme to achieve this. What will be the bandwidth requirement assuming each voice channel occupies 4000 Hz. The starting frequency of base band is 60 KHz. **(8)**

b. Distinguish between microwave, fiber optic and satellite links. **(8)**