

Subject: ANALOG COMMUNICATIONS

Time: 3 Hours

DECEMBER 2010

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 half an hour 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. Which of the following steps is not included in the process of reception?

- (A) Decoding
- (B) Encoding
- (C) Storage
- (D) Interpretation

b. Amplitude modulation is used for broadcasting because:

- (A) Immunity from noise
- (B) Requires less transmitter power
- (C) Lesser receiver complexity
- (D) Lesser bandwidth

c. Vestigial sideband modulation is normally used for:

- (A) HF communications
- (B) monaural broadcasting
- (C) TV broadcasting
- (D) stereo broadcasting

d. The difference between phase and frequency modulation:

- (A) purely theoretical
- (B) not compatible at all
- (C) audio response is poor in PM
- (D) different definition of modulation index

e. In broadcasting superheterodyne receiver, the:

- (A) local oscillator frequency is below signal frequency
- (B) mixer input must be tuned to the signal frequency
- (C) local oscillator frequency is normally double the IF
- (D) RF amplifier normally works at 455 kHz above the carrier frequency

f. To permit the selection of 1 out of 16 equi-probable events, the number of bits required is:

- (A) 2
- (B) $\log_{10} 16$
- (C) 8
- (D) 4

- g. Indicate which of the following system is digital
- (A) Pulse position modulation (B) Pulse code modulation
 (C) Pulse width modulation (D) Pulse frequency modulation
- h. Quantizing noise occurs in:
- (A) time division multiplexing (B) frequency division multiplexing
 (C) pulse code modulation (D) pulse width modulation
- i. Telephone traffic is measured:
- (A) with echo cancellers (B) by the relative congestion
 (C) in terms of grade of service (D) in erlangs
- j. Losses in optical fibres
- (A) impurities. (B) micro bending
 (C) attenuation (D) all of the above

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

- Q.2** a. Explain with a schematic block diagram, the basic communication system including transmitter and receiver. (8)
- b. Calculate the noise voltage at the input to an amplifier using a device that has $200\ \Omega$ equivalent resistance and a $300\ \Omega$ input resistor. The bandwidth of the amplifier is 6 MHz and the temperature is 17°C . (4)
- c. Briefly explain:
 (i) Signal to noise ratio.
 (ii) Noise figure. (4)
- Q.3** a. For an amplitude modulated wave prove $P_t = \left(1 + \frac{m^2}{2}\right) P_c$. (8)
- b. Define and describe SSB Transmission. (8)
- Q.4** a. Derive mathematical representation of FM. (8)
- b. A 25 MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier voltage is 4 V and maximum deviation is 10 kHz, write the equation of this modulated wave for (a) FM and (b) PM. If the modulating frequency is now changed to 2 kHz, all else remaining constant. Write a new equation for (c) FM and (d) PM. (8)

- Q.5** a. Briefly explain the function of the each of the blocks in the superheterodyne receiver. (8)
- b. Explain with the help of block diagram the operation of AGC. (8)
- Q.6** a. Briefly explain the advantages and applications of Smith Chart. (8)
- b. A coaxial cable, having an inner diameter of 0.25 mm and using an insulator with a dielectric constant of 2.56, is to have a characteristic impedance of $2000\ \Omega$. What must be the outer conductor diameter? (8)
- Q.7** a. What is dominant mode of operation for a waveguide? (4)
- b. Define phase and group velocity. (4)
- c. Briefly explain attenuation in waveguides. (4)
- d. Explain the difference between rectangular and circular waveguides. (4)
- Q.8** a. Define Shannon Hartley theorem. What is the fundamental importance of this theorem? (4)
- b. Calculate the capacity of a standard 4 kHz telephone with a 32 dB signal-to-noise ratio. (4)
- c. What is Companding and Expanding and how it is achieved? (8)
- Q.9** Write brief notes on:
- (i) International gateways
 - (ii) Echo and echo suppressor
 - (iii) Multiplexing
 - (iv) Microwave links (4×4)