

AMIETE – ET (Current & New Scheme)

Time: 3 Hours

December 2016

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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.

Q1. Choose the correct or the best alternative in the following: (2 × 10)

- a. A receiver connected to an antenna whose resistance is 50Ω has an equivalent noise resistance of 30Ω . The equivalent noise temperature is
 (A) 174 (B) 754
 (C) 147 (D) 464
- b. If the carrier of a 100 percent modulated AM wave is suppressed, the percentage power saving will be.
 (A) 50 (B) 150
 (C) 66.66 (D) 100
- c. To prevent overloading of the IF amplifier in a receiver, one should use
 (A) Squelch (B) Variable sensitivity
 (C) Variable selectivity (D) Double conversion
- c. A $(75-j50)\Omega$ load is connected to a coaxial transmission line of $Z_0 = 75\Omega$, at 10 GHz. The best method of matching consists in connecting
 (A) a short-circuited stub at the load
 (B) an inductance at the load
 (C) a capacitance at some specific distance
 (D) a short-circuited stub at some specific distance from the load
- e. Telephone traffic is measured
 (A) with echo cancellers
 (B) by the relative congestion
 (C) in terms of the grade of service
 (D) in erlang
- f. Three analog signals, having bandwidths 1200 Hz, 800 Hz, 600 Hz are sampled at their Nyquist rates, encoded with 12 bit words, and time division multiplexed. The bit rate for the multiplexed signal is
 (A) 31.2 kbps (B) 62.4 kbps
 (C) 57.6 kbps (D) 38.4 kbps
- g. In PCM, if the number of quantization levels is increased from 4 to 64, then the bandwidth requirement will approximately be increased _____ times.
 (A) 8 (B) 16
 (C) 3 (D) 32

- h. For a line of characteristic impedance, Z_0 terminated in a load, Z_R such that $Z_R > Z_0$, the voltage standing wave ratio (VSWR) is given by
 (A) Z_R / Z_0 (B) Z_R
 (C) Z_0 (D) Z_0 / Z_R
- i. In a phase shift SSB system, the phase shift at the audio frequency of 500 Hz is only 88° . To what extent will this frequency be present in the unwanted lower sideband?
 (A) 29.14 dB (B) 28.6 dB
 (C) 6.026 dB (D) -29.14 dB
- j. Which modulation system is digital?
 (A) Pulse position modulation (B) Pulse code modulation
 (C) Pulse amplitude modulation (D) Pulse width modulation

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

- Q. 2** a. Define noise figure, shot noise and thermal noise. (6)
 b. Derive the relation between noise figure and noise temperature. (5)
- c. A radio antenna pointed in a direction of the sky has a noise temperature of 50 K. The antenna feeds the receiver signal to the preamplifier which has a gain of 35 dB over a bandwidth of 10 MHz and a noise figure of 2 dB.
 i) Determine the effective noise temperature at the input to the amplifier.
 ii) determine the noise power at the output of the amplifier. (5)
- Q. 3** a. Define amplitude modulation and modulation index. Use a sketch of a sinusoidally modulated AM waveform to explain the definition. (4)
 b. An AM signal has the form (12)
- $$u(t) = [20 + 2 \cos 3000\pi t + 10 \cos 6000\pi t] \cos 2\pi f_c t$$
- Where $f_c = 0.1 \text{ MHz}$.
- (i) Sketch the voltage spectrum of $u(t)$.
 (ii) Determine the power in each of the frequency spectrum.
 (iii) Determine the modulation index.
 (iv) Determine power in the sidebands, the total power, and the ratio of the sidebands power to the total power.
- Q. 4** a. Calculate the percentage power saving when the carrier and one of the sideband are suppressed in an AM wave modulated to a depth of (i) 100 % and (ii) 50%. (4)
 b. Draw the circuit of a balanced modulator. Give the mathematical analysis to explain how and why only the carrier is suppressed in a balanced modulator. (8)
 c. Draw block diagram of a radio receiver and explain its functions. (4)
- Q. 5** a. In an FM system, when the audio frequency (AF) is 500 Hz and the AF voltage is 2.4 V, the deviation is 4.8 kHz. If the AF voltage is now increased to 7.2 V, what is the new deviation? If the AF voltage is raised to 10 V while the AF is dropped to 200 Hz, what is the deviation? Find the modulation index in each case. (8)
 b. Explain the direct method of generation of FM signals. (8)

- Q.6** a. Draw the block diagram of super heterodyne receiver and specify the importance of IF value in the receiver. List the advantages of such receiver. (8)
- b. Draw and explain the working of ratio detector. Also explain how it differs from Foster-Seelay? (8)
- Q.7** a. The parameters of a certain transmission line operating at $6 \times 10^8 \text{ rad/s}$ are $L = \frac{0.4 \mu\text{H}}{\text{m}}$, $C = \frac{40 \text{ pF}}{\text{m}}$, $G = 80 \text{ mS/m}$ and $R = 20 \text{ ohm/m}$.
- i) find $\gamma, \alpha, \beta, \lambda$ and Z_0
- ii) If a voltage wave travels 20 m down the line, by what percentage is its amplitude reduced, and by how many degrees its phase shifted? (10)
- b. Write a short note on Smith Chart. (6)
- Q.8** a. Determine the maximum number of half cycles of electric field with which it may propagate in a waveguide with a wall separation of 5 cm at a frequency of 10 GHz. Calculate the guide wavelength of this mode of propagation. (8)
- b. Calculate the ratio of the area of a circular waveguide to that of a rectangular one, if both have the same cut-off frequency for dominant mode. (8)
- Q.9** a. Explain PPM, PWM and PAM modulation schemes with the help proper waveforms. Also compare the relative performances of these schemes. (8)
- b. Write short notes on FDM. (8)