AMIETE – ET (Current & New Scheme)

Time: 3 Hours   **June 2018**   **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.**

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

a. The value of a resistor creating thermal noise is doubled. The noise power generated is therefore
   (A) Halved   **(B)** Quadrupled
   (C) Doubled   **(D)** Unchanged

b. In a communication system, noise is more likely to affect the signal
   (A) At the transmitter   **(B)** In the channel
   (C) In the information source   **(D)** At the destination

c. If the carrier of a 100% modulated AM wave is suppressed, the percentage power saving will be
   (A) 50%   **(B)** 150%
   (C) 100%   **(D)** 66.66%

d. A pre-emphasis circuit provides extra noise immunity by
   (A) Boosting the bass frequencies
   (B) Amplifying the higher audio frequencies
   (C) Pre-amplifying the whole audio band
   (D) Converting the phase modulation into Frequency Modulation

e. A Frequency Modulated signal with a modulation index of m_f is passed through a frequency tripler. The wave in the output of the tripler will have a modulation index of
   (A) $(m_f)/3$ **(B)** m_f
   (C) $3m_f$ **(D)** $9m_f$

f. A super-heterodyne receiver with an intermediate frequency of 450 kHz is tuned to a signal at 1200 kHz. The image frequency is
   (A) 750 kHz   **(B)** 900 kHz
   (C) 1650 kHz   **(D)** 2100 kHz

g. Impedance inversion may be obtained with
   (**A**) A short - circuited stub   (**B**) An open - circuited stub
   (**C**) A quarter - wave line   (**D**) A half – wave line

h. The wavelength of a wave in a waveguide
   (**A**) Is greater than in free space
   (**B**) Depends only on the waveguide dimensions and the free-space wavelength
   (**C**) Is inversely proportional to the phase velocity
   (**D**) Is directly proportional to the group velocity

i. The biggest disadvantage of PCM is
   (**A**) Its inability to handle analog signals
   (**B**) The high error rate which its quantizing noise introduces
   (**C**) Its incompatibility with TOM
   (**D**) The large bandwidths that are required for it

j. Satellites used for intercontinental communications are known as
   (**A**) Comsat   (**B**) Marisat
   (**C**) Domsat   (**D**) Intelsat

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

Q.2   a. List the basic functions of a radio transmitter and the corresponding functions of the receiver. **(8)**

   b. What are the different internal noises in the receiver? Explain in detail the Thermal noise. **(8)**

Q.3   a. Derive a mathematical expression for the frequency spectrum of the Amplitude Modulated (AM) wave. Explain with neat diagram the bandwidth requirement and power relations of the AM wave. **(8)**

   b. What is single side band suppressed carrier modulation? Explain its advantages with respect to ordinary Amplitude modulation. **(8)**

Q.4   a. What is the difference between Frequency and Phase modulation? In an FM system, if m_f is doubled by halving the modulating frequency, what will be the effect on the maximum deviation? **(8)**

   b. Explain in detail the advances of Frequency modulation over Amplitude modulation. **(8)**

Q.5   a. Explain the basic super-heterodyne principle with the aid of the block diagram of a simple receiver. **(8)**

   b. Explain the factors influencing the choice of the intermediate frequency for a radio receiver. **(8)**

Q.6 a. Explain with neat sketches the concept of impedance inversion by a quarter – wave line.   **(8)**

   b. Discuss the type of losses that may occur with RF transmission lines.   **(8)**

Q.7 a. What are waveguides? What is the fundamental difference between propagation in waveguides and propagation in transmission lines or free space?   **(8)**

   b. Describe various methods of coupling to cavity resonators. With the aid of a sketch, explain specifically how a cavity may be coupled to an electron beam.   **(8)**

Q.8 a. State and prove Shannon – Hartley Theorem.   **(8)**

   b. A 2-kHz channel has a signal-to-noise ratio of 24 dB.   **(4+4)**
      (a) Calculate the maximum capacity of this channel.
      (b) Assuming constant transmitting power, calculate the maximum capacity when the channel bandwidth is
         i. Halved
         ii. Reduced to a quarter of the original value.

Q.9 a. Show diagrammatically and with an explanation, how channels are combined into groups, and groups into super-groups, and so on, when FDM is generated in a practical system?   **(8)**

   b. Explain the working of Microwave Communication link with the help of a suitable block diagram.   **(8)**