DipIETE – ET (NEW SCHEME) – Code: DE61

Subject: ANALOG COMMUNICATIONS

Time: 3 Hours JUNE 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.**
- **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. Amplitude modulation is the process of _____.

(A) superimposing a low frequency on a high frequency.
(B) superimposing a high frequency on a low frequency.
(C) carrier interruption.
(D) frequency shift and phase shift.

b. One of the following types of noise becomes of great importance at high frequency.

(A) Shot noise **(B)** Random noise
(C) Impulse noise **(D)** Transit-time noise

c. What is the ratio of modulating power to total power at 100% modulation?

(A) 1:3 **(B)** 2:3
(C) 1:2 **(D)** None of the above

d. The difference between phase and frequency modulation _____.

(A) is purely theoretical because they are same in practice.
(B) is too great to make the two systems compatible.
(C) lies in the poorer audio response of phase modulation.
(D) lies in the different definitions of modulation index.

e. An FM signal of modulation index m_f is passed through a frequency tripler. The output of tripler will have a modulation index _____.

(A) $m_f/3$ **(B)** m_f
(C) $3m_f$ **(D)** $9m_f$

f. In a broadcast superheterodyne receiver, the _____.

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

g. Which of the following antennas is best excited from a waveguide?

(A) Biconical **(B)** Helical
(C) Horn **(D)** Discone

h. A piston attenuator is a _____.

(A) Vane attenuator **(B)** Mode filter
(C) Wave guide below cut off **(D)** Flap attenuator

i. To permit the selection of 1 out of 16 equiprobable events, the number of bits required is _____.

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

j. Higher order TDM levels are obtained by

(A) Dividing pulse widths **(B)** Using A-law network
(C) Using μ-law network **(D)** Forming supermaster groups

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

Q.2 a. Explain the basic communication system with a schematic block diagram. **(6)**

b. Discuss the need for modulation in communication system. **(4)**

c. What are sources of internal and external noise? Discuss any two for each type. **(6)**

Q.3 a. Explain the principle of Time-division multiplexing with a sketch to show how the interleaving of channel takes place. **(8)**

b. Draw the block diagram of a microwave link repeater, indicating the function of each block. **(8)**

Q.4 a. Derive an expression for AM wave using $V_c \sin \omega_c t$ as carrier and $V_m \sin \omega_m t$ as information signal. Plot its amplitude spectrum to show its frequency components. **(6)**

b. In a AM transmitter the unmodulated carrier power is 9 kW and when modulated its power is 10.125 kW. Find the modulation index. **(3)**

c. Explain the filter method of generation of SSB signal. **(7)**

Q.5 a. Obtain the mathematical representation of FM wave using $A_c \sin 2\pi f_c t$ as carrier and $A_m \sin 2\pi f_m t$ as modulating signal. **(6)**

b. Explain with circuits the application of pre-emphasis and de-emphasis in FM system. **(6)**

c. A sinusoidal modulating wave of amplitude 5 V and frequency 1 kHz is applied to a frequency modulator. The frequency sensitivity of modulator is 40 Hz/volt. Calculate the frequency deviation and modulation index. **(4)**

Q.6 a. With a schematic block diagram, explain the working of superheterodyne receiver. **(8)**

b. Specify Intermediate frequencies and explain the operation of IF amplifiers. **(8)**

Q.7 a. Write a note on Resonant and non-resonant antennas. **(6)**

b. What are lens antennas and explain zoned lens. **(6)**

c. Determine the length of an antenna operating at a frequency 1 MHz, assuming the velocity factor as 0.95. **(4)**

Q.8 a. Write a note on space wave propagation and show that the distance of communication is $d = 4\sqrt{h_t} + 4\sqrt{h_r}$ where h_t and h_r are the heights of transmitter and receiver respectively. **(6)**

b. Explain the field patterns for common modes in a rectangular waveguide. **(6)**

c. Calculate the cut-off wavelength for a standard rectangular wave guide operating in TM_{11} mode. **(4)**

Q.9 a. Explain the pulse position modulation system with relevant waveforms. **(6)**

b. What is companding and why is it required in pulse code modulation. **(6)**

c. What is Telegraphy? Describe briefly the system and machines used for transmitting and receiving it. **(4)**