Subject: ANALOG COMMUNICATIONS

Time: 3 Hours **Max. Marks: 100**

JUNE 2011

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 very high frequency (VHF) range extends from _____

(A) 3-30 MHz. **(B)** 30-300 MHz.
(C) 300-3000 MHz. **(D)** 3000-30000 MHz.

b. In order to separate channels in a TDM receiver, it is necessary to use _____

(A) AND gates. **(B)** differentiator.
(C) bandpass filter. **(D)** integrator.

c. The maximum power efficiency of AM modulator is _____

(A) 25 %. **(B)** 50 %.
(C) 75 %. **(D)** 100 %.

d. The modulation index for FM wave is defined as _____

(A) $\frac{f_m}{\Delta_f}$ **(B)** $\Delta f \, . f_m$

(C) $\frac{\Delta_f}{f_m}$ **(D)** $\Delta f - f_m$

e. Single Sideband system needs _____

(A) more bandwidth.
(B) high power.
(C) complex receiver circuit as compared to other type system.
(D) none of these.

f. The image channel rejection in a superheterodyne receiver comes from _____

(A) Detector, RF and IF stages. **(B)** RF stage only.
(C) Detector and RF stage only. **(D)** IF stage only.

g. The resonant antenna is characterised by _____

(A) presence of standing waves.
(B) a unidirectional radiation pattern of high directional gain.
(C) a bidirectional radiation pattern.
(D) both **(A)** and **(C)**.

h. The Maximum Usable Frequency (MUF) or secant law is expressed by relation _____ (if θ = angle of incidence)

(A) cos θ/critical frequency. **(B)** cos θ ×critical frequency.
(C) critical frequency/cos θ. **(D)** none of these .

i. In order to reduce cross-sectional dimensions, the wave guide to use _____

(A) rectangular. **(B)** circular.
(C) ridged. **(D)** flexible.

j. A PWM signal can be generated by _____

(A) a monostable multivibrator. **(B)** a crystal multivibrator.
(C) integrated the PPM signal. **(D)** differentiating the PPM signal.

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

Q.2 a. What is Shot noise? Describe the variables on which Shot noise depends. **(8)**

b. What is modulation? What is its necessity? **(4)**

c. The RF amplifier of a receiver has an input resistance of 1000Ω and an equivalent noise resistance of 2000 Ω. Calculate the noise figure and its equivalent noise temperature. **(4)**

Q.3 a. Derive the relationship between the total output power and depth of modulation in an AM transmitter. **(8)**

b. Calculate the percentage saving in power, if only one side band transmission is transmitted for **(8)**
(i) 80% modulation
(ii) 50% modulation

Q.4 a. Describe the concept of pre-emphasis and de-emphasis with the help of circuit diagram. **(8)**

b. In an FM systems, a 7 KHz signal modulates 107.6 MHz so that the frequen deviation is 50 KHz. Calculate **(8)**
(i) carrier swing in the FM signal and modulation index and
(ii) the highest and lowest frequencies attained by the FM signal, 2Δf

Q.5 a. What factors are to be considered while choosing the value of Intermediate Frequency (IF)? **(8)**

b. Explain how the RF amplifier, Local Oscillator and mixer circuit of a superheterodyne receiver maintains a constant frequency separation. **(8)**

Q.6 a. Define an antenna array and describe the construction features of various types of array antennas. **(8)**

b. A focal point feed parabolic reflector antenna has the following characteristics of its reflector mouth diameter = 2m , focal length = 2 m, if the 3 dB beam width of the antenna has been choosen to be 90% of the angle subtended by the feed at the edges of the reflector, determine (i) the 3 dB beam width and (ii) the null to null beam width of the antenna. **(8)**

Q.7 a. Explain how ionosphere is formed? Describe the importance of various layers of ionosphere. **(8)**

b. An air filled rectangular waveguide has dimensions 7.2 cm by 3.4 cm. Calculate group and phase velocities in the dominant mode at a frequency of 2.4 GHz. **(8)**

Q.8 a. Explain with a block diagram, how demodulation of PPM pulses can be achieved. List the advantages and disadvantages of PPM, over other type of systems. **(8)**

b. For a signal, the bandwidth is 3 KHz and S/N ratio is 15. Calculate **(8)**
(i) Channel capacity
(ii) If the bandwidth is increased to 4 KHz and signal is transmitted over the same channel. Also find calculate the required S/N ratio and the percentage change in signal power.

Q.9 a. How group is formed in a frequency Division Multiplex. Draw the block diagram of Channel Translating Equipment (CTE). **(8)**

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