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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3095 Roll No. | | | | | | | | | | |

B.Tech.

FIFTH SEMESTER EXAMINATION, 2006 - 07

ANALOG AND DIGITAL COMMUNICATION

Time : 3 Hours *Total Marks : 100*

Note : *(i) Answer ALL questions.*

(ii) All questions carry equal marks.

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your answer.

1. Attempt *any four* parts of the following : **(5x4=20)**

(a) List the basic functions of a radio transmitter and the corresponding functions of the receiver.

(b) Draw the basic blocks of communication system and explain the function of each block.

(c) Why the modulation is used in radio communication ? The carrier performs contain functions in radio communications. What are they ?

(d) A receiver has an overall gain A, an output resistance R_L a bandwidth δf, and an absolute operating temperature T. If the receiver's input resistance is equal to the antenna resistance Ra, derive a formula for the noise figure of this receiver.

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(e) An amplifier operating over the frequency range of 455 to 460 kHz has a 200 kΩ input resistor. What is the rms noise voltage at the input to this amplifier if the ambient temperature is 17°C?

2. Attempt *any four* parts of the following : **(5x4=20)**

(a) Define amplitude modulation and modulation index. Use the sketch of a sinusoidally modulated AM waveform to help in explanation of above definitions.

A 1000 kHz carrier is simultaneously modulated with 300 Hz, 800 Hz and 2 kHz audio sine waves. What will be the frequencies present in the output ?

(b) Derive the following for an ordinary AM;

$$\eta = \frac{m^2}{2+m^2} \times 100$$

where η = efficiency

m = modulation index

(c) What is single-side band suppressed carrier modulation ? What are its advantages with respect to ordinary A.M. ? Write the different methods of SSB generation. Explain any one in detail.

(d) In broadcast superheterodyne receiver having no RF amplier, the loaded Q of the antenna coupling circuit (at input to the mixer) is 100. If the intermediate frequency is 455 kHz, calculate :

(i) the image frequency and its rejection ratio at 1000 kHz

(ii) the image frequency and its rejection ratio at 25 MHz

(e) With the aid of the block-diagram of a simple receiver, explain the basic superheterodyne principle. Briefly explain the function of each blocks in the superheterodyne receiver.

3. Attempt *any two* parts of the following : **(10x2=20)**

(a) Describe frequency and phase modulation. Derive the formula for instantaneous value of an FM voltage and define the modulation index.
When the modulating frequency in an FM system is 400 Hz and modulating voltage is 2.4 V, the modulation index is 60. Calculate the maximum deviation. What is the modulating index when the modulating frequency is reduced to 250 Hz and the modulating voltage is simultaneously raised to 3.2 V ?

(b) Explain the affect of random noise on the output of FM receiver fitted with an amplitude limiter. Develop the concept of the noise triangle. What is pre-emphasis ? Why it is used ?

(c) Draw the complete block diagram of the Armstrong frequency modulation system. The equation of angle modulated voltage is $v = 10 \sin (10^8 t + 3 \sin 10^4 t)$. What form of angle modulation is this ? Calculate the carrier and modulating frequencies, the modulation index and deviation and the power dissipated is 100 Ω resistor.

4. Attempt *any two* parts of the following : **(10x2=20)**

(a) Define the term power density and explain why it is inversely proportional to the square of the distance from the source. Explain what is meant by terms isotropic source and isotropic medium. At 20 km in free space from a point source the power density is 200 $\mu W/m^2$. What is the power density 25 km away from this source ?

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(b) Describe ground wave propagation. What is the angle of tilt ? How does it affect field strength at a distance from the transmitter ?

Briefly describe the following terms connected with sky wave propagation.

(i) Virtual height

(ii) Fadeing

(c) Explain fully, what is pulse code modulation ? Draw one complete cycle of some irregular waveform, and show how it is quantized using eight standard levels.

What is the maximum capacity of a perfectly noiseless channel whose width is 120 Hz in which the value of the data transmitted may be indicated by any one of the 10 different amplitudes ?

5. Attempt *any two* parts of the following : **(10x2=20)**

(a) Show, diagrammatically and with an explanation, how channels are combined into groups and groups into subgroups and so on, when FDM is generated in practical system.

Explain the principle of time division multiplex with a sketch to show how the interleaving of channel takes place ?

(b) Briefly describe optical fibers and factor governing losses in fibers.

What are the advantages of optical fibers over co-axial cables ?

(c) Write short note on the following :

(i) Fiber optic components and systems

(ii) Installation, Testing and Repair of fiber cables

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