

2021

ELECTRONICS — HONOURS

Paper : CC-13

(Communication Electronics)

Full Marks : 50

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer **question no. 1** and **any four** from the rest.

1. Answer **any ten** questions of the following :

1×10

Indicate the correct alternative(s) (more than one option may be correct).

(a) The frequency that is used for radio communication is

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|--------------------|-------------------|
| (i) 10^{15} Hz | (ii) 10^{12} Hz |
| (iii) 10^{10} Hz | (iv) 10^5 Hz. |

(b) A balanced modulator produces

- (i) Single Side Band Suppressed Carrier signals
- (ii) Double Side Band Suppressed Carrier signals
- (iii) VSB modulation
- (iv) Independent Side Band Modulation.

(c) In frequency modulation the number of side bands is

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|----------------|---|
| (i) 2 | (ii) 4 |
| (iii) infinite | (iv) dependant on the modulation index. |

(d) In a Super-heterodyne receiver

- (i) a mixer and a local oscillator are ganged to produce an intermediate frequency
- (ii) the local oscillator produces a frequency close in frequency to the incoming signal being received
- (iii) the local oscillator frequency is less than signal frequency
- (iv) the sensitivity is less than a TRF.

(e) At low frequencies Flicker noise can be completely ignored above

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|------------|-------------|
| (i) 500Hz | (ii) 10Hz |
| (iii) 1kHz | (iv) 250Hz. |

Please Turn Over

- (f) The theoretical maximum information transfer rate of the channel, for a particular noise level is called
- (i) sampling rate (ii) signalling rate
(iii) Shannon limit (iv) Baud rate.
- (g) For an N bit quantization in digital communication the whole space is partitioned into
- (i) $2N$ (ii) $N/2$
(iii) N^2 (iv) 2^N subspaces.
- (h) The digital modulation technique used in frequency selective channels is
- (i) FSK (ii) ASK
(iii) BPSK (iv) QPSK.
- (i) In a PCM system the number of quantization levels are 16 and the maximum signal frequency is 4kHz, then the bit transmission rate is
- (i) 64 Kbits/sec (ii) 16 Kbits/sec
(iii) 32 Kbits/sec (iv) 32 bits/sec.
- (j) In FM bandwidth is affected by
- (i) modulation index only
(ii) modulating frequency only
(iii) both modulation index and modulating frequency
(iv) carrier frequency.
- (k) Amplitude modulation produces an output signal the bandwidth of which is
- (i) f_m (ii) $2f_m$
(iii) $f_m/2$ (iv) $4f_m$
where f_m is the maximum frequency of the modulating signal.
- (l) PAM signals can be demodulated by using a
- (i) Low pass filter (ii) Schmitt trigger followed by a LPF
(iii) differentiator followed by a LPF (iv) clipper followed by a LPF.

2. (a) What is the need for modulation in case of electronic communication?

(b) What is amplitude modulation? Find the expression for instantaneous voltage of AM.

(c) Find the expression for the power in an amplitude modulated wave. 2+(2+3)+3

3. (a) Give the circuit for the detection of AM and explain its operation.

(b) What are meant by frequency division and modulation index in case of FM?

(c) Discuss how FM is generated using VCO. 4+(2+2)+2

4. (a) Give the block diagram of an FM transmitter and state the function of the blocks.
(b) Calculate the power in one of the side band in SSBSC modulation when the carrier power is 248 W and there is 80% modulation depth in the amplitude modulated signal.
(c) Define Modulation Index. 5+3+2
5. (a) If a digital signal is given under four conditions, such as voltage levels, frequencies, phases and amplitude find the number of bits necessary to produce the given number of conditions in case of M-array coding.
(b) Explain with a suitable diagram what is meant by sampling in analog pulse modulation. What is sampling rate?
(c) State sampling theorem. 2+(4+2)+2
6. (a) State four advantages and two disadvantages of digital communication.
(b) What is pulse code modulation? Explain what is meant by quantisation.
(c) Calculate the minimum S/N ratio to reduce the effect of noise on a 3 kHz data channel. (2+1)+(2+3)+2
7. (a) What is noise? What are meant by internal noise and external noise? What is signal to noise ratio?
(b) A resistor of $20\text{ K}\Omega$ is at 300 K. Calculate, for a bandwidth 100kHz, the thermal noise voltage in the resistor. (Boltzmann constant = $8.6 \times 10^{-5}\text{ eV/K}$).
(c) What is meant by channel in electronic communication? (2+2+2)+2+2
8. (a) What do you mean by channel capacity and multiplexing?
(b) Explain Time Division Multiplexing Method (TDM).
(c) What are the limitations of TDM?
(d) Write down the applications of TDM. (2+2)+3+2+1
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