



EEEN 462 – ANALOGUE COMMUNICATION

TELEVISION ENGINEERING – TEST YOUR KNOWLEDGE

1. **PAL analogue video signals use**
 - a) 625 lines/frame
 - b) 30 fps interlaced
 - c) 25 fps progressive
 - d) 405 lines/frame
2. **The purpose of interlaced scanning is to**
 - a) Increase resolution
 - b) Reduce flicker without doubling bandwidth
 - c) Enable colour transmission
 - d) Improve audio synchronization
3. **In analogue TV, the luminance signal is transmitted using**
 - a) Frequency modulation (FM)
 - b) Amplitude modulation (AM)
 - c) Vestigial Sideband Modulation (VSB)
 - d) Single Sideband Modulation (SSB)
4. **The standard NTSC channel bandwidth is**
 - a) 4.2 MHz
 - b) 5.5 MHz
 - c) 6 MHz
 - d) 8 MHz
5. **The colour subcarrier frequency in NTSC is approximately.....**
 - a) 3.58 MHz
 - b) 4.43 MHz
 - c) 1.3 MHz
 - d) 15.734 kHz

6. **The QAM modulation in NTSC colour transmission refers to**

- a) Quadrature Amplitude Modulation of I/Q signals
- b) Frequency modulation of chroma
- c) Phase modulation of sync pulses
- d) Digital audio encoding

7. **The function of the "back porch" in analogue video is to**

- a) Carry audio signals
- b) Insert colour burst reference
- c) Reset CRT beam current
- d) Transmit closed captioning

8. **Gamma correction compensates for**

- a) CRT phosphor nonlinearity
- b) Camera sensor noise
- c) RF interference
- d) Audio/video delay

9. **SECAM differs from NTSC/PAL primarily in its**

- a) Sequential colour transmission
- b) Higher resolution
- c) Wider channel bandwidth
- d) Digital audio encoding

10. **The Kell factor accounts for**

- a) Interlace scan artifacts
- b) Effective resolution loss in sampled systems
- c) Color subcarrier interference
- d) Audio/video synchronization

11. **Digital television in the Kenya uses**

- a) DVB-T
- b) 8-VSB modulation
- c) COFDM
- d) QPSK

12. **MPEG-2 transport streams multiplex**

- a) Video, audio, and metadata packets
- b) Analog sync signals

- c) Chrominance/luminance components
- d) RF carrier waves

13. The "4:2:2" chroma subsampling means

- a) Full chroma resolution horizontally
- b) Half chroma resolution horizontally and vertically
- c) Half horizontal chroma resolution, full vertical
- d) Quarter chroma resolution

14. In DVB-T, guard intervals mitigate

- a) Colour bleeding
- b) Multipath interference
- c) Gamma distortion
- d) Interlace flicker

15. The function of horizontal blanking is to

- a) Reset CRT beam from right to left
- b) Insert vertical sync pulses
- c) Transmit audio subcarriers
- d) Enable closed captioning

16. Composite video signals combine

- a) Luminance + chrominance + sync
- b) R/G/B + audio
- c) I/Q + luminance
- d) Digital transport streams

17. The NTSC "tint" control adjusts

- a) Chrominance amplitude
- b) Subcarrier phase
- c) Luminance gain
- d) Audio frequency

18. In digital TV, the GOP (Group of Pictures) includes

- a) I-frames, P-frames, B-frames
- b) Sync pulses + blanking
- c) Chroma burst + back porch
- d) Audio/video packets

19. **The primary audio carrier in analog NTSC is located**
- a) 4.5 MHz above video carrier
 - b) At 41.25 MHz
 - c) Within the VSB spectrum
 - d) At the color subcarrier frequency
20. **ATSC frame rates include 60p, 30p, and 24p to support**
- a) Film-originated content
 - b) SECAM compatibility
 - c) Analog interlaced signals
 - d) Monochrome transmission

TRUE/FALSE QUESTIONS

21. NTSC and PAL both use 525 lines per frame.
22. VSB modulation allows simpler receiver filters than SSB.
23. The I (In-phase) signal in NTSC has higher bandwidth than Q (Quadrature).
24. Digital TV eliminates the need for horizontal/vertical sync pulses.
25. COFDM (DVB-T) is more robust to multipath than 8-VSB (ATSC).

SHORT ANSWER QUESTIONS

26. **Explain why interlaced scanning causes "interline flicker" artifacts.**
27. **Describe how quadrature modulation enables color transmission in NTSC without increasing bandwidth.**
28. **Calculate the bandwidth for a 720p60 HDTV signal (1280×720, 8-bit color, 4:2:0 subsampling).**
29. **Compare MPEG-2 vs. H.264 compression efficiency for digital TV.**
30. **Explain how vestigial sideband (VSB) filtering works in analog TV transmitters.**

MODEL ANSWERS

MULTIPLE CHOICE

1. b)
2. b)
3. c)
4. c)
5. a)
6. a)
7. b)
8. a)
9. a)
10. b)
11. b)
12. a)
13. c)
14. b)
15. a)
16. a)
17. b)
18. a)
19. a)
20. a)

TRUE/FALSE QUESTIONS

21. F (PAL uses 625 lines)
22. T
23. T (I: 1.5 MHz, Q: 0.5 MHz)
24. F (Replaced by MPEG timing headers)

25. T

SHORT ANSWER QUESTIONS

26. **Interline flicker:** Odd/even scan lines refresh at different times, causing high-contrast edges to appear to vibrate at 30 Hz.

27. **Quadrature modulation:** I/Q chroma signals modulate the same subcarrier in phase quadrature. At receiver, synchronous detection separates them using phase-sensitive demodulation.

28. **Bandwidth calculation:**

- Luminance: $1280 \times 720 \times 60 \text{ fps} \times 8 \text{ bits} = 442 \text{ Mbps}$
- Chroma (4:2:0): $(1280 \times 720 \times 0.5) \times 60 \times 8 = 221 \text{ Mbps}$
- Total uncompressed: **663 Mbps** ($\approx 83 \text{ MHz}$ for binary transmission)

29. **Compression comparison:**

- H.264 (AVC) provides $\sim 50\%$ better compression than MPEG-2 at same quality
- Uses smaller block sizes, spatial prediction, improved entropy coding

30. **VSB operation:**

- Full upper sideband + partial lower sideband (vestige) transmitted
- Filters remove most of lower sideband (e.g., 0.75 MHz retained in NTSC)
- Receiver uses complementary filter for flat frequency response