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Analog Communication Important Questions PDF

Analog Communication usually covers amplitude modulation and its variants, angle modulation (FM and PM), radio receivers, noise in communication systems, and pulse modulation with multiplexing. Common numericals are AM power and efficiency, Carson's bandwidth, image frequency, thermal noise and Friis formula, while long answers cover SSB generation, FM generation and detection, and the superheterodyne receiver.

Key takeaways

- Amplitude modulation: AM power, modulation index, efficiency, DSB-SC, SSB, VSB, generation and detection.
- Angle modulation: frequency deviation, modulation index, Carson's rule, NBFM, WBFM, pre-emphasis and de-emphasis.
- Receivers: superheterodyne, intermediate frequency, image frequency, selectivity, sensitivity and AGC.
- Noise and pulse modulation: thermal noise, noise figure, Friis formula, figure of merit, PAM, PWM, PPM, TDM and FDM.
- These are practice questions based on common syllabus topics, not verified past papers.

About these important questions

These are **practice questions** built from topics that appear in most Indian B.Tech syllabi for Analog Communication, including AKTU and universities that follow the AICTE model curriculum. They are **not verified past papers**, and we do not claim that any question will appear in your exam. Unit numbers and topic order differ between universities, so first match each unit below with your own university syllabus. For real previous papers, use your university's official archive. AKTU students can download them from the AKTU old question paper page.

Each unit lists key definitions, derivations or theory questions, numericals with short answer outlines, and long-answer questions. Use the outlines to check your method, then write full solutions yourself.

Unit 1: Amplitude Modulation

Key definitions: need for modulation, AM wave, modulation index, over-modulation, sidebands, bandwidth, DSB-SC, SSB-SC, VSB, envelope detector, synchronous detection.

Results to remember: $s(t) = Ac[1 + \mu \cos(\omega m\, t)] \cos(\omega c\, t)$; total power $Pt = Pc(1 + \mu^2/2)$; efficiency $\eta = \mu^2/(2 + \mu^2)$, which is 33.3% at $\mu = 1$; AM bandwidth = 2fm.

Numericals (answer outline):

- Carrier power 10 kW, μ = 0.5. Find the total power. Answer: Pt = 10(1 + 0.125) = 11.25 kW.
- Find μ from the maximum and minimum envelope values: μ = (Vmax - Vmin)/(Vmax + Vmin).
- An AM wave is modulated by two tones with μ1 and μ2. The effective index is μ = √(μ1² + μ2²).
- Find the power saving in DSB-SC and SSB compared with full AM at μ = 1. Answer: about 66.7% and 83.3%.

Long-answer questions: Explain the generation of AM using a square-law modulator and a switching modulator. Explain SSB generation by the filter method and the phase-shift method. Explain envelope detection and the condition on the RC time constant.

Unit 2: Angle Modulation

Key definitions: frequency modulation, phase modulation, frequency deviation, modulation index β = Δf/fm, narrowband and wideband FM, Bessel function spectrum, Carson's rule, pre-emphasis, de-emphasis.

Numericals (answer outline):

- Commercial FM with Δf = 75 kHz and fm = 15 kHz. Find β and the bandwidth. Answer: β = 5 and Carson's bandwidth = 2(75 + 15) = 180 kHz.
- Find the significant sidebands from the Bessel function table for a given β.
- Find the new deviation and bandwidth when the modulating amplitude or frequency is doubled.

Long-answer questions: Compare FM and AM. Explain the generation of FM by the direct (varactor) method and the indirect (Armstrong) method. Explain FM detection using a slope detector, a Foster-Seeley discriminator, a ratio detector or a PLL.

Unit 3: Radio Receivers

Key definitions: tuned radio frequency receiver, superheterodyne receiver, intermediate frequency, image frequency, image rejection ratio, selectivity, sensitivity, fidelity, AGC, tracking.

Numericals (answer outline):

- An AM receiver with IF = 455 kHz is tuned to 1000 kHz. Find the local oscillator and image frequencies. Answer: LO = 1455 kHz and image = 1000 + 2 x 455 = 1910 kHz.
- Find the image rejection ratio for a given Q of the RF stage: α = √(1 + Q²ρ²), where ρ = fsi/fs - fs/fsi.

Long-answer questions: Draw and explain the block diagram of a superheterodyne AM receiver. Explain why the local oscillator frequency is usually kept above the signal frequency. Explain the FM receiver, including the limiter and the de-emphasis network.

Unit 4: Noise in Communication Systems

Key definitions: thermal noise, shot noise, white noise, noise power spectral density, signal-to-noise ratio, noise figure, noise temperature, Friis formula, figure of merit.

Results to remember: thermal noise power N = kTB; noise voltage Vn = √(4kTBR); Friis formula F = F1 + (F2 - 1)/G1 + (F3 - 1)/(G1G2) + ...; figure of merit for AM with envelope detection at μ = 1 is 1/3, and for FM it is 3β²/2.

Numericals (answer outline):

- Find the noise voltage across a resistor at room temperature for a given bandwidth.
- Find the overall noise figure of a three-stage amplifier using the Friis formula. The first stage dominates, which is why a low-noise amplifier is used first.
- Convert noise figure to equivalent noise temperature: Te = (F - 1)T0, with T0 = 290 K.

Long-answer questions: Derive the figure of merit of DSB-SC and FM systems, and explain the threshold effect in FM.

Unit 5: Pulse Modulation and Multiplexing

Key definitions: sampling theorem, natural and flat-top sampling, aperture effect, PAM, PWM, PPM, TDM, FDM, guard band.

Important questions:

- Explain the generation and detection of PAM, PWM and PPM with waveforms.
- Explain flat-top sampling and the aperture effect, and how an equaliser corrects it.
- Compare TDM and FDM.
- Find the minimum sampling rate and the TDM bit or pulse rate for a given number of channels, each with a given bandwidth.

How to score well in Analog Communication

- Draw waveforms and spectra for every modulation scheme. Examiners expect them.
- Keep a formula sheet for AM power, FM bandwidth, image frequency, noise and Friis formula.
- Learn the block diagrams of the AM and FM superheterodyne receivers fully.
- Write units (kHz, MHz, dB) in every numerical answer.

Short-answer (2-mark) questions for Analog Communication

Short questions test definitions and one-line results. Practise answering each in two to four lines:

1. Why is modulation needed?
2. Define the modulation index of AM.
3. What happens when μ is greater than 1?
4. What is the bandwidth of an SSB signal? (Answer: fm.)
5. Define frequency deviation.
6. State Carson's rule.
7. Why is pre-emphasis used in FM?
8. What is image frequency?
9. Define the sensitivity and selectivity of a receiver.
10. Define noise figure.

11. What is the threshold effect in FM?
12. Differentiate between PAM and PPM.

A 7-day revision plan for Analog Communication

Use this plan in the last week before the exam. Adjust it to the units and weightage in your own syllabus.

- **Day 1 (Unit 1, Amplitude Modulation):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 2 (Unit 2, Angle Modulation):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 3 (Unit 3, Radio Receivers):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 4 (Unit 4, Noise in Communication Systems):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 5 (Unit 5, Pulse Modulation and Multiplexing):** revise the definitions, then solve the numericals and one long answer from this unit without notes.
- **Day 6:** attempt one full three-hour practice paper made from these questions, or an official previous paper from your university archive.
- **Day 7:** go through your formula sheet, the short-answer list and every question you got wrong in the practice paper.

Frequently asked questions

Which numericals are most common in Analog Communication?

AM power and efficiency, modulation index from envelope values, Carson's bandwidth, image frequency, thermal noise voltage and the Friis noise figure formula are the most common.

Is Analog Communication still useful when most systems are digital?

Yes. Modulation, bandwidth, noise and receiver concepts are the base for digital communication, and they are part of GATE ECE and many core company tests.

How should I learn the superheterodyne receiver?

Draw the block diagram from memory, write the role of each block in one line and practise LO and image frequency numericals. This covers most receiver questions.

Are these questions from real past papers?

No. These are practice questions based on topics that are common in B.Tech syllabi. They are not verified past papers, and no question is promised to appear in your exam. Check your own university syllabus and official previous papers; AKTU students can use the AKTU old question paper archive.

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