GUJARAT TECHNOLOGICAL UNIVERSITY

BE-5 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:
Analog and Digital Communication (3151104)

Unit 1 – Introduction to Communication System

(7 hours, 20% weightage)

Repeated Questions:

1. **Draw and explain the block diagram of a communication system.**
   - Appeared in: W24 (Q1c, 07 marks), W23 (Q1c, 07 marks), S22 (Q1c, 07 marks)
2. **Define modulation. Why is modulation required?**
   - Appeared in: W24 (Q1b, 04 marks), S22 (Q1b, 04 marks)
3. **Define SNR and Channel Capacity.**
   - Appeared in: W24 (Q1a, 03 marks), W22 (Q1a, 03 marks)
4. **Compare analog and digital communication.**
   - Appeared in: S23 (Q1a, 03 marks), S24 (Q1b, 04 marks)
5. **Explain noise immunity of digital signals.**
   - Appeared in: W22 (Q1b, 04 marks), S24 (Q1b, 04 marks)

Other Important Questions:

1. **Define Modulation Index, SNR, and Channel Capacity.**
   - Appeared in: W24 (Q1a, 03 marks)
2. **Explain modulation process and its requirements.**
   - Appeared in: S25 (Q1b, 04 marks)
3. **Define: Modulation Index, Power Spectral Density, Signal Distortion.**
   - Appeared in: S22 (Q1a, 03 marks)
4. **Explain the history of communications.**
   (Not directly asked, but part of syllabus)
5. **Explain signal distortion over a communication channel.**
   - Appeared in: S24 (Q2c, 07 marks)
6. **Explain signal energy, energy spectral density, signal power, and power spectral density.**
   (Theoretical, part of syllabus)

Unit 2 – Amplitude Modulation and Demodulation

(7 hours, 15% weightage)

Repeated Questions:

1. **Explain DSB amplitude modulation with necessary figures/expressions.**
   - Appeared in: W25 (Q3a, 03 marks), W24 (Q3a, 03 marks), W22 (Q2a, 03 marks)
2. **Compare AM and FM systems.**
   - Appeared in: W24 (Q2a, 03 marks), S22 (Q2a, 03 marks), S23 (Q1b, 04 marks)
3. **Explain envelope detector method for AM detection.**
   - Appeared in: W24 (Q2c, 07 marks), W23 (Q2c, 07 marks), S24 (Q3c, 07 marks)
4. **What is modulation index? Derive sideband power and total power in AM.**
   - Appeared in: S25 (Q2c, 07 marks), S23 (Q2c, 07 marks), W23 (Q2c, 07 marks)
5. **Explain VSB (Vestigial Sideband) modulation.**
   - Appeared in: S25 (Q3b, 04 marks), S23 (Q2a, 03 marks), W22 (Q2c, 07 marks)

Other Important Questions:

1. **Explain under-modulation, perfect modulation, and over-modulation.**
   - Appeared in: W23 (Q2b, 04 marks)
2. **Explain SSB generation using filter method.**
   - Appeared in: S25 (Q3c, 07 marks), S24 (Q1c, 07 marks), S22 (Q2c, 07 marks)
3. **Compare DSB-FC, DSB-SC, SSB, VSB.**
   - Appeared in: S23 (Q3a, 03 marks)
4. **Explain PLL (Phase-Locked Loop).**
   - Appeared in: W22 (Q2b, 04 marks), S24 (Q2c, 07 marks)
5. **Explain FDM (Frequency Division Multiplexing).**
   - Appeared in: S25 (Q1c, part)
6. **Explain sideband splatter in AM.**
   - Appeared in: S25 (Q1c, part)
7. **Explain local carrier synchronization.**
   (Theoretical, part of syllabus)
8. **Numerical: AM power calculation with given modulation index.**
   - Appeared in: W23 (Q2c, 07 marks), S24 (Q3a, 03 marks)
9. **Numerical: Sketch AM signal, carrier, modulation index, frequency spectrum.**
   - Appeared in: W24 (Q2b, 04 marks), S22 (Q2b, 04 marks)
10. **Explain Armstrong method of FM generation (indirect method).**
    - Appeared in: W24 (Q2c, 07 marks), S22 (Q2c, 07 marks), S24 (Q3c, 07 marks)

Unit 3 – Angle Modulation and Demodulation

(7 hours, 15% weightage)

Repeated Questions:

1. **Define FM and PM. Establish the relationship between them.**
   - Appeared in: W25 (Q2b, 04 marks)
2. **Explain pre-emphasis and de-emphasis in FM.**
   - Appeared in: W25 (Q5c, 07 marks), W24 (Q3b, 04 marks), S22 (Q3b, 04 marks)
3. **State Carson's rule in FM.**
   - Appeared in: W24 (Q3a, 03 marks), S23 (Q3b, 04 marks), S25 (Q3a, 03 marks)
4. **Explain FM broadcasting system.**
   - Appeared in: W25 (Q5b, 04 marks)
5. **Explain superheterodyne receiver with block diagram.**
   - Appeared in: W24 (Q3c, 07 marks), W23 (Q3c, 07 marks), S22 (Q3c, 07 marks)

Other Important Questions:

1. **Explain bandwidth analysis of angle-modulated waves.**
   - Appeared in: W25 (Q4a, 03 marks)
2. **Explain indirect method (Armstrong) of FM generation.**
   - Appeared in: S25 (Q3c, 07 marks)
3. **Explain FM demodulation using PLL.**
   - Appeared in: W22 (Q3b, 04 marks)
4. **Define modulation index for FM.**
   - Appeared in: W22 (Q3a, 03 marks)
5. **Numerical: FM modulation index, frequency deviation, carrier swing.**
   - Appeared in: W24 (Q3c, 07 marks), S23 (Q3c, 07 marks)
6. **Explain nonlinear distortion and interference in FM.**
   (Theoretical, part of syllabus)
7. **Explain unique features of FM.**
   - Appeared in: W22 (Q3a, 03 marks)
8. **Explain FM receiver.**
   - Appeared in: W22 (Q3c, 07 marks)
9. **Numerical: FM wave equation analysis (carrier frequency, modulating frequency, deviation).**
   - Appeared in: S24 (Q3a, 03 marks), S23 (Q3c, 07 marks)
10. **Explain generating FM waves (direct vs indirect methods).**
    - Appeared in: W22 (Q3b, 04 marks), W23 (Q4c, 07 marks)

Unit 4 – Sampling and Analog to Digital Conversion

(9 hours, 20% weightage)

Repeated Questions:

1. **State and prove sampling theorem.**
   - Appeared in: W25 (Q1b, 04 marks), W24 (Q4a, 03 marks), S23 (Q1c, 07 marks), S22 (Q4b, 04 marks)
2. **What is aliasing? How to avoid it?**
   - Appeared in: W25 (Q2c, 07 marks), S24 (Q4c, 07 marks), S23 (Q4a, 03 marks)
3. **Compare PCM, DPCM, and Delta modulation.**
   - Appeared in: W24 (Q3b, 04 marks), W23 (Q3b, 04 marks)
4. **Explain delta modulation and its advantages/disadvantages.**
   - Appeared in: W25 (Q5c, 07 marks), S24 (Q4c, 07 marks), S23 (Q4a, 03 marks)
5. **Explain companding in PCM.**
   - Appeared in: W25 (Q5a, 03 marks), S25 (Q5b, 04 marks), S23 (Q4b, 04 marks)

Other Important Questions:

1. **Explain quantization. Compare linear vs nonlinear quantization.**
   - Appeared in: W25 (Q3d, 07 marks)
2. **Explain ADPCM.**
   - Appeared in: W25 (Q3b, 04 marks)
3. **Explain DPCM in detail.**
   - Appeared in: W25 (Q3c, 07 marks), W24 (Q4c, 07 marks)
4. **Explain adaptive delta modulation.**
   - Appeared in: W25 (Q4b, 04 marks), S25 (Q4c, 07 marks)
5. **Explain sampling and signal reconstruction.**
   - Appeared in: W25 (Q4b, 04 marks), W22 (Q4b, 04 marks)
6. **Explain T1 carrier system.**
   - Appeared in: S25 (Q5c, 07 marks)
7. **Numerical: Nyquist rate and interval calculation.**
   - Appeared in: S24 (Q4a, 03 marks)
8. **Numerical: PCM bit rate, bandwidth, SNR calculation.**
   - Appeared in: S23 (Q4c, 07 marks), S23 (Q4c, 07 marks)
9. **Explain mid-rise and mid-tread quantizers.**
   - Appeared in: W23 (Q4b, 04 marks)
10. **Explain practical issues in signal sampling and reconstruction.**
    - Appeared in: W25 (Q4b, 04 marks)
11. **Explain sample and hold circuit.**
    - Appeared in: S24 (Q5b, 04 marks)
12. **Explain non-uniform quantization.**
    - Appeared in: S24 (Q4a, 03 marks)
13. **Explain slope overload and hunting in delta modulation.**
    - Appeared in: W24 (Q4b, 04 marks), S23 (Q4b, 04 marks)
14. **Derive expression for quantization error.**
    - Appeared in: S25 (Q4b, 04 marks)

Unit 5 – Digital Data Transmission

(9 hours, 20% weightage)

Repeated Questions:

1. **What is line coding? Explain different line coding schemes.**
   - Appeared in: W25 (Q3c, 07 marks), S23 (Q5a, 03 marks), S22 (Q4a, 03 marks)
2. **Draw waveforms for Unipolar NRZ, RZ, Polar RZ for given data stream.**
   - Appeared in: W24 (Q5a, 03 marks), S23 (Q5a, 03 marks), S22 (Q5b, 04 marks)
3. **What is ISI? Explain Nyquist's criterion for zero ISI.**
   - Appeared in: W25 (Q4c, 07 marks), S24 (Q5c, 07 marks), S22 (Q4a, 03 marks)
4. **Explain eye diagram and its uses.**
   - Appeared in: W25 (Q5a, 03 marks), S24 (Q4b, 04 marks), W24 (Q5b, 04 marks)
5. **Explain regenerative repeater with block diagram.**
   - Appeared in: W24 (Q5c, 07 marks), S25 (Q4c, 07 marks), S24 (Q5a, 03 marks)

Other Important Questions:

1. **Explain scrambling and descrambling.**
   - Appeared in: W25 (Q3a, 03 marks), S23 (Q5c, 07 marks), S22 (Q5a, 03 marks)
2. **Compare BPSK, QPSK, DPSK.**
   - Appeared in: W24 (Q5b, 04 marks), S23 (Q5b, 04 marks)
3. **Explain ASK, FSK, PSK modulation techniques.**
   - Appeared in: W24 (Q5a, 03 marks), S24 (Q3b, 04 marks), S23 (Q5b, 04 marks)
4. **Explain M-ary communication.**
   - Appeared in: W22 (Q5a, 03 marks)
5. **Explain pulse shaping and its need.**
   - Appeared in: S25 (Q4a, 03 marks)
6. **Explain equalizers (zero forcing equalizer).**
   - Appeared in: W25 (Q4c, 07 marks), S22 (Q5a, 03 marks)
7. **Explain timing extraction and detection error probability.**
   (Theoretical, part of syllabus)
8. **Explain digital carrier systems.**
   (Theoretical, part of syllabus)
9. **Explain GMSK modulation.**
   - Appeared in: W25 (Q5b, 04 marks), S22 (Q5c, 07 marks)
10. **Explain MSK modulation.**
    - Appeared in: S22 (Q5c, 07 marks)
11. **Explain coherent/non-coherent detection of ASK/FSK.**
    - Appeared in: W24 (Q5a, 03 marks), S22 (Q5a, 03 marks), S22 (Q5b, 04 marks)
12. **Explain OQPSK waveform generation.**
    - Appeared in: S23 (Q5b, 04 marks)
13. **Derive PSD of polar NRZ line code.**
    - Appeared in: S24 (Q5c, 07 marks)
14. **Explain properties of line codes.**
    - Appeared in: S24 (Q4b, 04 marks)
15. **Compare polar, bipolar, unipolar line codes.**
    - Appeared in: S25 (Q5a, 03 marks), S24 (Q5a, 03 marks)

Unit 6 – Introduction to Digital Modulation-Demodulation Techniques

(6 hours, included in Unit 5 weightage)
(Note: This unit is often combined with Unit 5 in questions)
Repeated Questions:

1. **Explain ASK, FSK, PSK, BPSK, QPSK, DPSK, MSK, GMSK.**
   (Covered in Unit 5 repeatedly)
2. **Draw ASK, FSK, BPSK waveforms for given bit stream.**
   - Appeared in: W23 (Q5b, 04 marks), S24 (Q3b, 04 marks)
3. **Compare ASK and FSK.**
   - Appeared in: W23 (Q5a, 03 marks), S22 (Q5b, 04 marks)
4. **Explain QPSK modulation in detail.**
   - Appeared in: W25 (Q1c, 07 marks)

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