Interview Grading Rubric for AM/FM Simulation Exercise

Objectives:

1. Demonstrate the ability to calculate and predict the spectrum of an analog modulated signal, given the carrier frequency, type of modulation, and modulation index.
2. Apply Matlab to simulate the time-domain and frequency spectrum of an AM and FM modulated signal.
3. Compare the theoretical predictions and simulated results of an analog modulated signal.
4. Quantitatively evaluate the differences between theory and simulation.
5. Explain one or more practical benefits of analog modulation to transmit information across a channel.

Criteria:

<table>
<thead>
<tr>
<th>Score</th>
<th>Level</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>Advanced</td>
<td>Full understanding and mastery of the topic; answers are clear, concise, and professionally presented.</td>
</tr>
<tr>
<td>2</td>
<td>Intermediate</td>
<td>Understands and can address the topic with prompting or outside assistance (notes/textbook). Supplementary material (figures/table/code) are clean and concisely documented.</td>
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<tr>
<td>1</td>
<td>Novice</td>
<td>Minimal understanding of the topic; requires heavy assistance from notes, text, and instructor. Supplementary material (figures/table/code) have errors or lack context.</td>
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<tr>
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### 1. Present an overview of the analog modulation and theoretical predictions.

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| 3     | - Predictions are correct and professionally presented.  
- Clearly and concisely explains relationship of modulation index to time and frequency-domain signals.  
- Clearly and concisely explains how modulation is used to convey information over a channel. |
| 2     | - Predictions are correct, but with gaps in explanation or understanding.  
- Explanation of analog modulation and theoretical predictions requires prompting or referral to notes/textbook.  
- Explanation of how modulation is used to convey information requires prompting or referral to notes/textbook. |
| 1     | - Predictions have errors or gaps; explanation demonstrates only minimal understanding.  
- Can explain predicted results but cannot place into the context of communications theory/operation and/or requires heavy assistance from notes/text.  
- Explanation of application of modulation has major gaps, “magic numbers” or missing key details/information. |
| 0     | - Predictions have major errors; explanation demonstrates lack of understanding.  
- Cannot explain theoretical predictions.  
- Cannot demonstrate understanding of how modulation operates. |

### 2. Present Matlab simulation results for the AM and FM Signal.

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| 3     | - Figures are correct, and professionally presented with axes, titles, units, and labels; figures have correct ranges.  
- Demonstrates impact of modulation index on both the time-domain signal and sampled signal spectrum.  
- Compares predicted signals to simulated signals in terms of frequencies present as well as any temporal and spectral effects.  
- Code is fully documented within code and via oral explanation. |
| 2     | - Figures and results are correct, but with gaps in explanation or understanding; figures may have minor presentation issues.  
- Demonstrates impact of modulation index frequency on both the time-domain signal and sampled signal spectrum with prompting from the instructor.  
- Compares predicted signals to simulated signals in terms of frequencies present as well as any temporal and spectral effects with prompting from the instructor.  
- Code documentation contains gaps / explanation of code operation requires prompting or referral to notes/textbook. |
| 1     | - Figures and code have errors or gaps; explanation demonstrates only minimal understanding; Figures have significant presentation flaws.  
- Shows different modulation indexes but cannot connect choices of modulation index to temporal/spectral results.  
- Links predicted results to simulated results only in most simplistic sense.  
- Code documentation and explanation has major gaps, “magic numbers” or missing key details/information. |
| 0     | - Figures and code have major errors.  
- Modulation explanation demonstrates lack of understanding.  
- Cannot relate theory to simulation results.  
- Cannot demonstrate understanding of how simulation operates. |
### 3. Quantitatively compare the theoretical predicted results to the simulated performance (see table).

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| 3     | - Figures are correct, and professionally presented with axes, titles, units, and labels; figures have correct ranges.  
    - Addresses any anomalies in the simulated signals with reasonable explanation.  
    - Explains observed impact of any chosen parameters (e.g., sampling frequency, number of samples) on both the time-domain signal and sampled signal spectrum.  
    - Links predicted and simulated results and places into context of Analog Modulation. |
| 2     | - Figures and results are correct, but with gaps in explanation or understanding; figures may have minor presentation issues.  
    - Superficially discusses anomalies in the simulated signals.  
    - Gaps in explanation observed impact of any chosen parameters (e.g., sampling frequency, number of samples) on both the time-domain signal and sampled signal spectrum.  
    - Links predicted and simulated results and places into context of Analog Modulation with gaps or prompting. |
| 1     | - Figures and code have errors or gaps; explanation demonstrates only minimal understanding; figures have presentation flaws.  
    - Superficially discusses impact of modulation or simulation parameters on both the time-domain signal and sampled signal spectrum.  
    - Superficially discusses predicted and simulated results and places into context of Analog Modulation with gaps or prompting. |
| 0     | - Figures and code have major errors.  
    - Sampling theorem explanation demonstrates lack of understanding.  
    - Cannot relate sampling theorem to measured results. |

### 4. Follow-On Questions:

- **Explain the practical applications of analog modulation.**  
- **Qualitatively describe the differences between AM and FM.**  
- **Qualitatively describe the benefits and tradeoffs of AM and FM.**

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