# Course Profile: Biomedical Engineering Program

<table>
<thead>
<tr>
<th>COURSE #: BIOMEDE 311</th>
<th>COURSE TITLE: BIOMEDICAL SIGNAL AND SYSTEMS</th>
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</thead>
<tbody>
<tr>
<td>TERMS OFFERED: Winter</td>
<td>PREREQUISITES: Math 216; BME 211, EECS 215 or EECS 314</td>
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<tr>
<td>TEXTBOOKS/REQUIRED MATERIAL:</td>
<td>COGNIZANT FACULTY: Noll, Cain, O'Donnell</td>
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<tr>
<td>INSTRUCTOR(S): Noll</td>
<td>SCIENCE/DESIGN: 3/1</td>
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## CATALOG DESCRIPTION:
Theory and practice of signals and systems in both continuous and discrete time domains with examples from biomedical signal processing and control. Continuous-time linear systems: convolution, steady-state responses, Fourier and Laplace transforms, transfer functions, poles and zeros, stability, sampling, feedback. Discrete-time linear systems: Z transform, filters, Fourier transform, signal processing.

## COURSE TOPICS:
1. Linear, Time-Invariant (LTI) systems
2. Convolution, impulse response, step response
3. Fourier series representation of signals
4. Frequency responses of LTI systems
5. Fourier transforms
6. Laplace and Z-transforms
7. System block diagrams

## COURSE OBJECTIVES
Links shown in brackets are to the departmental educational objectives.
1. To teach students the basic tools for analysis of linear, time-invariant (LTI) systems [1,5].
2. To introduce students to concept of the frequency decomposition of signals and to the spectral analysis of systems [1,5].
3. To train students in the design and analysis of filters [1,5].
4. To teach students the relationship between discrete and continuous domain signals [1,5].
5. To introduce students to the concept of system stability in both continuous and discrete domains [1,5].
6. To prepare students for further study in biomedical signal processing and systems analysis [10,11,12,13].
7. To introduce students to the analysis of biological and biomedical signals and systems using standard systems analysis tools [10,11,12,13].

## COURSE OUTCOMES
Links shown in brackets are to the course objectives.
1. Describe and identify LTI systems [1].
2. Describe input/output relationships for LTI systems in both time and frequency domain [1,2,7].
3. Analyze periodic signal using the Fourier series [2,4].
4. Understand the relationship between the Fourier series and Fourier transform [2,4].
5. Characterize the frequency response for LTI systems [2,3,4,7].
6. Determine the Fourier transform of continuous and discrete domain signals [2,4].
7. Describe signals and systems using the Laplace and Z-transforms [4,5,6,7].
8. Characterized system stability and causality using pole-zero plots [3,5,6,7].

## ASSESSMENT TOOLS
Links shown in brackets are to the course outcomes.
1. Topical midterm exams and a comprehensive final exam [1-8]
2. Weekly homework sets will collaboration including Matlab problems [1-8]
3. End of term course evaluations by each student [1-8]