**DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING**
**COURSE SYLLABUS**

| *COURSE TITLE* | *ENGLISH CODE/NO* | *ARABIC CODE/NO.* | *CREDITS* | | | |
|---|---|---|---|---|---|---|
| | | | *Th.* | *Pr.* | *Tr.* | *Total* |
| Biomedical Signals and Systems | EE 470 | 470 هـ ك | 3 | 1 | | 4 |
| ***Pre-requisites:*** | EE 321, EE 370, EE 374, and IE 202 | | | | | |
| ***Course Role in Curriculum*** | *Required or Elective:* | | Required | | | |
| | *A pre-requisite for:* | | Graduation | | | |

***Catalogue Description:***
Definition of signals and systems. Types of signals. Examples of biomedical signals and systems. Mathematical description of signals, continuous- and discrete-time signals, scaling and shifting transformations, differentiation and integration, differencing and accumulation. Description of systems, block diagrams, system terminology, system characteristics, and convolution integral. Analysis of signals and systems using Fourier series and Fourier transform. Introduction to z-transform and its applications in digital filtering. Biomedical signals and systems applications.

***Primary Textbook*:**

1. Luis Chapparo, *Signals and Systems Using Matlab*, 2nd ed., Academic Press, 2015. (ISBN: 978-0-12-394812-0)

***Supplementary Materials*:**

- ***References:***
  - M. J. Roberts, Signals and Systems, Analysis Using Transform Methods and MATLAB, McGraw-Hill, International Edition 2004. (ISBN: 007-123268-0).
  - Simon Haykin & Barry Van Deen, Signals and Systems, 2nd ed., Prentice Hall, 2003.
  - Mrinal Mandal, and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
  - Michael C. K. Khoo, Physiological Control Systems: Analysis, Simulation, and Estimation, IEEE Press 2000. (ISBN 0-7803-3408-6)
- ***Web Resources:***
  - Instructor's course web site (additional handouts and lecture presentations)

***Course Learning Outcomes:***

*By the completion of the course the student should be able to:*

1. Mathematically describe signals
2. Perform different mathematical manipulations on signals
3. Build custom functions using combinations of popular functions
4. Model biomedical systems using differential equations
5. Solve differential equations to understand behavior of systems
6. Develop frequency response equation of a system from its Bode plot
7. Design reliable and relevant experiments to test biomedical systems
8. Test for the transient responses of RC and RLC circuits for different applications.
9. Identify systems parameters based on their transient responses.
10. Design passive analog and digital filters for biomedical applications
11. Identify noise and distortion in biomedical systems
12. Build custom functions using MATLAB
13. Apply Fourier transform to analyze biomedical signals and systems using MATLAB
14. Plot signals in both time and frequency domain using MATLAB
15. Plot impulse and step responses of systems using MATLAB
16. Design and simulate biomedical systems using MATLAB or Simulink

| | ***Topics to be Covered:*** | ***Duration in Weeks*** |
|---|---|---|
| 1. | Continuous-Time Signals | 1 |
| 2. | Continuous-Time Systems | 1 |
| 3. | The Laplace Transform | 2 |
| 4. | The Fourier Transform | 2 |
| 5. | Sampling Theory | 2 |
| 6. | Discrete-Time Signals and Systems | 2 |
| 7. | The Z-Transform | 1 |
| 8. | Fourier Analysis of Discrete-Time Signals and Systems | 1 |
| 9. | Introduction to the Design of Discrete Filters | 1 |

***Student Outcomes addressed by the course:*** (Put a √ sign)

| | | |
|---|---|---|
| (a) | an ability to apply knowledge of mathematics, science, and engineering | √ |
| (b) | an ability to design and conduct experiments, as well as to analyze and interpret data | √ |
| (c) | an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability | |
| (d) | an ability to function on multidisciplinary teams | |
| (e) | an ability to identify, formulate, and solve engineering problems | √ |
| (f) | an understanding of professional and ethical responsibility | |
| (g) | an ability to communicate effectively | |

| | | |
|---|---|---|
| (h) | the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context | |
| (i) | a recognition of the need for, and an ability to engage in life-long learning | |
| (j) | a knowledge of contemporary issues | |
| (m) | an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. | |

***Key Student Outcomes assessed in the course***: (a), (b), and (e)

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***Instructor or course coordinator:***

Yasser Mostafa Kadah
Professor, BME Program.
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**Office:** Bldg#40, Rm24G05.
**Office hours:** TBD.

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***Evaluation Criteria***

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|---|---|
| Class Homeworks | 20% |
| Lab Experiments | 20% |
| Written Quizzes | 20% |
| Projects/Practical Exam | 20% |
| Final Exam | 20% |

***Last updated:*** January 10, 2016