COURSE PLAN 2021/1
REMOTE DISCIPLINE

Associate Professor:
Suélia S. R. F. Rosa – Electric Engineer – suelia@unb.br
Ronni G. G. Amorim – Theoretical Physicist – ronniamorim@unb.br

Schedule: Wednesday 18:00 às 22:00
Plataforma de Ensino: https://teams.microsoft.com/
Open channels: WhatsApp – PPG_Course
Chat Teams Team
E-mail

COURSE: The introduction to the dynamic modelling techniques used in contemporary research in Biomedical Engineering and Bioengineering will be studied. The course is suitable for advanced graduate students, with a defined theme and orientation. Mathematical modelling is a tool that involves the use of calculations and software development. The classes will provide a basis for developing mathematical models using: i) Bond Graph Technical (by Profa. Suelia Fleury) and ii) Fractional Calculus Applied to Biomedical Engineering (by Prof. Ronni). The course will promote in the student a knowledge of computer modelling to better analyse their research question.
APPOINTMENT:

1) Synchronous meetings at the times established by the discipline with a new agenda discussed with the students (Following tools will be used: The chanel of PPGEB in Youtube (https://www.youtube.com/channel/UCrlUsSmL0izxC6rcAwMGZMg) MicrosoftTeams; Whatssap, Moodle Plataform).

2) Guarantee of Access to Teachers via WhatsApp for Monitoring; Clarification of Doubts and Assistance; Receiving Difficulty Reports linked to the technology and internet variable.

3) Final Evaluation of the Discipline, by the Students, - as a way of verifying the quality taught by the teacher.

4) Flexibility to the deadlines for carrying out activities, following the agenda built with the class.

5) Communicate and provide feedback to students and the institution - for Coordination.

6) Ensure that all material used in the classroom, books and academic content is made available to students without prejudice and with equity.

7) There will be no printing of material, all activities will be done in a virtual or manual or digital way, without the need for printing.

8) Clearly define the tasks, deadlines, and delivery method.

9) Guarantee individual feedback - with private discussions - if necessary.

10) Checking for plagiarism using tools https://www.turnitin.com/ that provide feedback.

GENERAL PROGRAM

The program will be divided in two parts,

Part 1 by Professor Suelia Fleury – **Overview of Systems Biology and Biotechnology**
Part 2 by Prof Ronni – Fractional Calculus Applied to Biomedical Engineering: - Historical aspects of fractional calculus. – Fundamental Tools: Gamma and Beta functions; Laplace Transform; Mittag-Leffler functions; Gelfand-Shilov function. – Fractional Integral: Kinds of fractional integrals; Riemann-Liouville fractional integral; Properties of Riemann-Liouville fractional integral. – Fractional Derivative: Definitions; Riemann-Liouville fractional derivative; Caputo fractional derivative; Properties of Caputo Fractional Derivative. – Fractional Differential Equations: Definitions; elementary fractional differential equations. – Applications of Fractional Calculus in Biomedical Engineering: study of case using fractional logistic equation.

TEACHING METHODOLOGY

(X) Use of Youtube Video
(X) Use of Quis, Google and APP Systems (Nearpod - ThingLink)
(X) Use of TED Talks Video
(X) Use of discussion seminars
(X) Use WhatsApp
(X) Teams - camera on and frequency counted, time that must be present in the virtual mode at least 80% of the total time of the lesson, recorded lesson.
(X) Use of extra-class material
(X) Extended Summary Writing
(X) Digital Material Generation - drawings, graphs and analyses.

CONDITIONS FOR APPROVAL:

The grades will be counted in each activity that is scored - the students received partial grades every 3 weeks for personal control of their progress. Review the material we’ll cover each week, and preview the assignments you’ll need to complete to pass the course.

NA - theoretical and practical assessments - individual and group.
NAF is a simple average of the evaluation scores.

NE - extra-class and class activity to be carried out - individual and group.

NEF is a simple average of activity scores.

\[ AL = \text{simple mean of NAF and NEF}. \]

THE STUDENT WILL BE CONSIDERED APPROVED if \( AL \geq 5.0 \)

THE STUDENT WILL BE CONSIDERED FAILED if \( AL < 5.0 \).

Omitted cases - and not mentioned in this plan will be dealt with according to the University's by laws. Please if doubt you should be to consult:


**Week/Lectures/Professor**

<table>
<thead>
<tr>
<th>Date</th>
<th>Subject</th>
<th>Part 1 and Part 2</th>
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| Open Class | Course Information, Program Overview of Systems Biology and Biotechnology Simulation. | Virtual classroom: Lecture 1  
After class: Assignment 1  
Supplementary Files: Computing with MATLAB;  
OPENCADD https://www.youtube.com/c/Opencadd/playlists;  
MATLAB https://www.youtube.com/user/MATLAB  
Read - Plenitude e Completude de Fazer Ciência |
| July 26th  |  
| August 2nd | Introduction to System Dynamics. System Decomposition and Model Complexity.  
https://www.youtube.com/watch?v=k1wyljFpwPc  
Virtual classroom: Part 1 with Prof Fleury  
After class: Assignment 2  
Supplementary Files: Computing with MATLAB; and Read Paper  
Read: Novas tecnologias aplicadas à saúde: integração de áreas transformando a Sociedade.* |
| August 9th |  
|           |  | Before classroom:  
Virtual classroom: |
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<th>Date</th>
<th>Topic</th>
<th>Before classroom:</th>
<th>Virtual classroom:</th>
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<td>August 23rd</td>
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<td>August 30th</td>
<td>Basic 2-Ports Elements. Junction Elements. Simple Bond Graph Examples General Guidelines. Mechanical Translation. Mechanical Rotation.</td>
<td>Read Text Chapter- (Text Book) - RESEARCH ARTICLE 2</td>
<td>Part 1 with Prof Fleury</td>
<td>Assignment 4</td>
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<td>September 6th</td>
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<td>Read Novas tecnologias aplicadas à saúde: desenvolvimento de Sistemas Dinâmicos - Conceitos, aplicações e utilização de técnicas inteligentes e regulação</td>
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<td>September 20th</td>
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<td>September 27th</td>
<td>Algebraic Loops and Derivative Causality. Bond Graph applied in Biology Systems.</td>
<td>Read Text Chapter- (Text Book) - RESEARCH ARTICLE 3</td>
<td>Part 1 with Prof Fleury</td>
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<td>Date</td>
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| **October 4th** | **After classroom:** Analysis  
**Supplementary Files:** Recording video with discussion |
| **October 11th** | **Before classroom:**  
**Virtual classroom:**  
**After classroom:**  
**Supplementary Files:** |
| **October 18th** | **Before classroom:**  
**Virtual classroom:**  
**After classroom:**  
**Supplementary Files:** |
| **October 25th** | **Before classroom:** Write brief  
**RESEARCH ARTICLE 4**  
**Virtual classroom:** Part 1 with Prof Fleury  
**After classroom:** Review other students brief  
**Supplementary Files:** Read Article |
| **November 1st** | **Avaliação?** |
| **November 5th** | **Close Class Overview**  
**Final Lecture** |

**BASIC BIBLIOGRAPHY**

**System Dynamics and Control with Bond Graph Modeling** Edição Inglês | por Javier Kypuros, Publisher, CRC Press 2013, ISBN 9781466560765. (Text Book)

Bond Graph in Modeling, Simulation and Fault Identification (English Edition) Edição Inglês | por Ranjit Karmakar & Arun Kumar Samantaray Amalendu Mukherjee.

Diabetes Ground Control: A Novel System for Correcting Anomalous Stride in Diabetic Patients

By Suélia de Siqueira Rodrigues Fleury Rosa, Mário Fabrício Fleury Rosa, Marcella Lemos Brettas Carneiro, Leticia Coelho, Diego Colón and Célia Aparecida Reis DOI: 10.5772/intechopen.74040


SSRF Rosa, ÊKF Souza, PAA Urbizagástegui, LRT Peixoto, AF Rocha, Modelagem matemática da tíbia humana usando Bond Graph, Revista Brasileira de Engenharia Biomédica 29, 329-342


Modeling of the human tibia bone using Bond Graph - https://doi.org/10.4322/rbeb.2013.042