MATHEMATICAL ASPECTS OF BIOMEDICAL ELECTRONIC SYSTEM DESIGN

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PRE-REQUISITES : Basic Electronics

INTENDED AUDIENCE : Engineering students, Faculty from Engineering Colleges, Medical Students

COURSE OUTLINE :

This course is a system design-oriented course aimed to provide exposure to mathematical analysis and its importance in the translational biomedical systems. Biomedical electronics and subsequent mathematical analysis are popular research areas, and this course is an introduction to both. The emphasis is on biostatistical aspects with an introduction to standard Biological system design and experimental protocols. Expected course outcomes:

- Introduction to Biomedical optics
- Multimodal Approaches for Tissue phenotyping
- Mathematical Modelling of Biomedical System Design
- Acquisition, Preprocessing and Analysis of Biological Signals
- Demonstration of EEGLab and ERPLab for EEG and ERP signal processing

ABOUT INSTRUCTOR :

Prof. Chandramani Kishore Singh is currently an Assistant Professor with the Department of Electronic Systems Engineering, Indian Institute of Science, Bengaluru. He received the M.E. and Ph.D. degrees in Electrical Communication Engineering from the Indian Institute of Science, Bengaluru, India, in 2005 and 2012, respectively. He then worked as a Wireless Communications Engineer in ESQUBE Communications Solutions Pvt. Ltd., Bengaluru, from 2005 to 2006. He was a Post-Doctoral Researcher with TREC, a joint research team between INRIA Rocquencourt and ENS de Paris from 2012 to 2013 and with the Coordinated Science Laboratory, University of Illinois at Urbana–Champaign, USA, from 2013 to 2014. His interests are in the areas of communication networks, data centers, information centric networking, federated learning etc.

COURSE PLAN :

Week 1**:** Signals and Systems

Week 2**:** Signal Representation

Week 3**:** Linear Algebra

Week 4**:** Stochastic Modeling

Week 5**:** Biomedical system design for neuroscience applications

Week 6**:** IoT protocols – Brain Computer Interfaces Signal Processing

Week 7**:** Understanding electro-thermo-mechanical properties of biological tissues

Week 8**:** Microsensors for label-free phenotyping of solid tissue tumours

Week 9**:** Mathematical models for understanding tumour progression in breast cancer

Week 10**:** Introduction to Biomedical Optics: Theory and Mathematical modeling

Week 11**:** Design and development of biomedical optical tools

Week 12**:** Multimodal optical and ultrasound techniques