Biosensors EEL3050

Dr. Swati Rajput
Department of Electrical Engineering, IIT Jodhpur

Sensor Key Parameters

Owing to the nature of the applications in which biosensors are used in, several characteristics or parameters have to be met when a biosensor is designed. These characteristics define the performance and usefulness of a biosensor.

- **Sensitivity**
- **Selectivity**
- **Stability**
- **Detection Limit**
- **Reproducibility**
- **Response Time**

Numerical Problems on Biosensor's Key Parameters

Problem 1: A biosensor is designed to detect a specific analyte. When exposed to the analyte, the sensor's response increases according to the equation $R(t)=R_{final}\times(1-e^{-t/\tau})$ where R(t) is the sensor output at time t, R_{final} is the final response, and τ is the time constant. If the sensor reaches 80% of its final response in 10 seconds, calculate the time constant τ of the sensor.

Problem 2: Two biosensors, A and B, have time constants of 6 seconds and 15 seconds, respectively. Determine the time required for each sensor to reach 90% of its final response.

Problem 3: A biosensor is tested multiple times under identical conditions and gives the following results: 1.02 µM, 1.03 µM, 1.01 µM, 1.04 µM, and 1.02 µM. Compute the reproducibility of the biosensor in terms of the standard deviation and the coefficient of variation (CV).

Numerical Problems on Biosensor's Key Parameters

Problem 4: A biosensor has a standard deviation of the blank measurements (no analyte) of 0.4 mV and a sensitivity of 0.8 mV/µM. Calculate the Limit of Detection (LOD).

Problem 5: A biosensor has a dynamic range of 250 and can measure up to a maximum concentration of 2000 µM. Determine the lower limit of detection (LOD) for this biosensor.