

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	BTech in Electronics and Instrumentation Engineering
Semester:	VII
Course Code:	4EI401ME25
Course Title:	Soft Sensors
Course Type:	Department Elective-IV
Year of Introduction:	2024-25

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. illustrate the methods for soft sensor design (BL2)
2. select appropriate model structure of soft sensor (BL3)
3. discover fault detection and diagnosis in industrial process (BL4)
4. recommend soft sensor for industrial applications. (BL6)

Unit	Contents	Teaching hours (Total 45)
Unit- I	Introduction Soft Sensor, types of soft sensor's design approaches	04
Unit- II	Applications of Soft Sensors Back-up of measuring devices, reducing the measuring hardware requirements, real-time estimation for monitoring and control	06
Unit- III	Soft sensor design Identification of variables, data selection and filtering, missing data handling, outlier detection methods, model structure selection, model validation, multivariate statistical techniques, artificial intelligent techniques.	12
Unit-IV	Choice of the model structure Static models, Linear dynamic models, Soft computing identification strategies, methods for input and regressor selection.	07
Unit- V	Applications of soft sensors in fault detection and diagnosis Basic terminology in fault detection and diagnosis, an overview of fault detection and diagnosis, model-based fault detection, fault models, fault detection approaches, symptom analysis and fault diagnosis, hybrid approaches to industrial fault detection and diagnosis	08
Unit- VI	Case studies Case studies related to soft sensor design for refineries, chemical plants, cement kilns, food processing industries, power plants, urban and industrial pollution monitoring and civil engineering	08

Self Study:

The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial:

Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

Suggested Reading:

1. Luigi Fortuna, Salvatore Graziani, Alessandro Rizzo, Maria G. Xibilia, *Soft sensors for monitoring and control of industrial processes*, Springer.
2. Pablo Antonio Lopez Perez, Ricardo Aguilar Lopez, Ricardo Femat, *Control in Bioprocessing: Modelling, estimation and the use soft sensors*, Wiley.
3. Rajamani Doraiswami, Maryhelen Stevenson, Chris Diduch, *Identification of physical systems: Applications to condition monitoring, fault diagnosis, soft sensor and controller design*, Wiley.

Suggested List of Tutorial :

Sr. No.	Title
1.	Review the applications of soft sensors in process control.
2.	Review the soft sensor design based on neural network in the field of bioprocesses
3.	Review the soft sensor applications in field of steel industries
4.	Case study of soft sensor as part of fault detection
5.	Review the soft sensor applications in the field of petrochemical industries
6.	Review the soft sensor applications in the field of waste water treatment plant
7.	Review the soft sensor applications in the field of pharmaceutical industry
8.	Review the soft sensor applications in the field of food processing industry
9.	Review the soft sensor applications in the field of pulp paper industry
10.	Review the soft sensor applications in power plant