Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2019-2020
Course Handout (Part II)

Date: 06/01/2020

In addition to part I (General Handout for all courses appended to the time table) this portion gives further more specific details regarding this course.
Course No. : CHEM F414
Course Title : BIO and CHEMICAL SENSORS
Instructor-in-charge: Jayanty Subbalakshmi

1. **Scope and Objective of the Course**: The main objective of this course is to introduce students about the chemical sensors and biosensors and familiarize them with different types of sensors, properties and their applications. This course also deals with the aspects of sensors and the principles on which they are based on. Students will gain knowledge on the selectivity feature of the sensor and focus on the performance factors such as how long can it be used, how much can it detect etc. Classification of biological sensors like enzymes, antibodies, antigens etc. will be taught. Understanding olfactory system through chemical sensors will be dealt. Knowledge, definition and design of various electrochemical sensors, mechanism of their sensitivity and selectivity will also be highlighted. Finally, a comprehensive perspective of recent advances and technological applications of bio and chemical sensors with examples covering real case studies will be enlightened.

2. **Text Book**:

T1: Brian R. Eggins, "Chemical Sensors and Biosensors" 2007, John Wiley & Sons Ltd.
T2: Jiri Janata, "Principles of Chemical Sensors" 2009, 2nd Ed., Springer.

3. **Reference Book:**

R1: Florinel-Gabriel Bănică, "Chemical Sensors and Biosensors" 2014, Wiley publishers.

The syllabus also includes lectures and tutorial class notes.

4. **Course Plan**:

No. Lectures	Learning Objectives	Contents to be covered	Learning Outcomes of the lectures	Chapter in the Text Book
1-3	Introduction	Definitions, Introduction to recognition methods, transduction elements, sensor fabrication and calibration	Define fundamental terms in sensors Draw/label, sketch of sensor device Methodology to, in general fabricate and calibrate sensors	T1: Chapter 1
4-7	Performance Factors	Selectivity, Sensitivity, time factors, detection and quantification capabilities	Gain knowledge on the selectivity feature of the sensor and focus on the performance factors such as how long can it be used, how much can it detect etc. Overall we learn about	T1: Chapter 4

			the capability of sensor.	
8-11	Mass sensors	Piezoelectric effect-principles and applications, QCM	Detailed study on mass sensors by getting key insight about piezoelectric property. Design of Quartz crystal microbalance	T2: Chapter 4
12-16	Biological Recognition Agents	Enzymatic sensors, antibodies, chemical noses and tongues	Concept of recognition, visualize and classify biological sensors like enzymes, antibodies, antigens etc. Understanding olfactory system through chemical sensors.	T1: Chapter 3
17-21(3)	Sensors based on Nanomaterials	CN, metallic nanoparticles, semiconductor nanocrystals, Silica NPs, Dendrimers	To Know the molecular structures, synthesis and utilization and application of carbon nanotubes, silica, dendrimers and semiconductor based nanoparticles as molecular sensors.	R1, T1, Research papers etc.
22-25(3)	Thermal Sensors	Temperature transducers, Enzymatic thermal sensors, thermocatalytic sensors, thermistors, structure and applications	Differentiate between sensors and transducers. Thermal and thermocatalytic sensors. Design of Thermistor and its sensitivity study. Applications of thermal sensors.	T1: Chapter 7 R1: Chapter 9
26-31(4)	Optical Sensors	Optical waveguide in chemical sensors, spectrochemical transduction methods, fiber optic sensor array, applications	Introducing various optical properties. Understanding concept of wave guide with diagram. Detailed knowledge of chemical sensors. Design of fiber optic array. Knowing about Mach-Zehnder Interferometer, Resonant mirror etc.	R1 : Chapter 18,19
31-34(3)	Optical Sensors: Applications	Nanomaterial Applications in Optical Transduction	Usage of nanomaterials like lanthanide compounds, porous silicon etc. in optical transduction and optical sensing.	T2: Chapter 9 R1 : Chapter 20
35-38	Electrochemic-al Sensors	Methods and Materials, Amperometric, potentiometric and conductometric sensors	Knowledge, definition and design of various electrochemical sensors, mechanism of their sensitivity and selectivity. Calculation of selectivity parameter.	T1 : Chapter 5 T2: Chapter 5 R1: Chapter 10, 13
39-41	Specific Applications	Specific Applications	Comprehend the recent advances and technological applications of bio and chemical sensors with examples covering case studies.	T1, T2, R1, Research articles, Class Notes etc.

5. Evaluation Scheme:

Component	Durati	Weightage	Date, Day & Time	Nature of

	on	%		Component
Mid-Semester Test	90 min	35%	5/3 3.30 - 5.00 PM	Closed Book
Assignments/lab component/ Quiz/small projects	-	20%	-	Open Book
Comprehensive Examination	3 hrs	45%	11/05 FN	Closed Book

6. Chamber consultation hours: To be announced in the class.

7. Notices: Notices concerning the course will be displayed on the chemistry notice board/on the CMS.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

9. Make-up-policy: Make up would be considered only for very genuine reasons (*such as institute deputation outside for sports/cultural fest, hospitalization (with appropriate documentary proof)* and in case of any other extreme emergency situations.

Instructor-in-charge

Prof. Jayanty Subbalakshmi