BTOE 005: CHEMICAL SENSORS AND BIOSENSORS

Course Objective: To understand the deep insight into chemical sensors (including biosensors) and their practical applications.

Credits: 03 **L-T-P-J: 3-0-0-0**

Module No.	Course Content	Teaching Hours/ Percentage
I	**Biosensors and Immuno biosensors**: Introduction – amperometric enzyme electrodes-characteristics- enzyme activity determinations – biosensors for enzyme immunoassay – Potentiometric enzyme electrodes – electrode characteristics and performance –pH glass and ion-selective electrodes – solid-state pH and redox electrodes –gas electrodes. Potentiometric immunobiosensors – immobilization techniques – analytical applications. Principle and measurements of enzyme thermistor devices. Transducer – experimental techniques – types of biological element: immobilized enzymes – immobilized cells – determination of enzyme activities in solution	**10//25%**
II	**Chemically mediated and redox based hydro-gel based biosensors**: Introduction – sensing chemistry and materials –sensing techniques –transducer types. Transducer-based fiber optic biosensors – Optical biosensors based on competitive binding. Electron conducting redox polymer in biosensors –enzyme electrodes – specific sensor examples. Hybridization at oligonucleotide sensitive electrodes: function of oligonucleotide sensitive electrodes – hybridization efficiency and sensitivity – probe oligonucleotide structure and dynamics – hybridization conditions – hybridization kinetics.	**10//25%**
III	**Fluorophore and chromophores based fiberoptic biosensors**: Enzyme based nonmediated fiberoptic biosensors – chromophores and flurophore detection. Bioluminescence and chemiluminescence based fiberoptic sensors – bioluminescence and chemiluminecent reactions – analytical potential of luminescent reactions – applications	**10/25%**

IV	**Determination of metal ions by fluorescence anisotropy**: Theory of anisotropy based determination of metal ions – fluorescent aryl sulfonamides for zinc determination-removal of zinc from carbonic anhydrase – determination of zinc using reagent approach – determination of copper and other ions by using reagentless approach.	**10/25%**

Text Books/ Reference Books:

- Copper J. M. and Cass E. G. A., "Biosensors", Oxford University Press, 2004.
- Brian Eggins, "Chemical Sensors and Biosensors", John Willey & Sons, 2002.
- Copper J. M. and Cass E. G. A., "Biosensors", Oxford University Press, 2004.
- Blum L. J. and Coulet P. R., "Biosensor Principles and Applications", Marcel Dekker Inc., 1991.

Course Outcome:

CO1: Students can describe the operation principles for chemical sensors based on electrochemical, optical, mass and thermal transduction

CO2: Students can explain the operation principle of potentiometric, amperometric and conductometric sensors and give examples of their applications

CO3: Students can give examples of chemical sensors based on conducting polymers.

CO4: Students can determine the selectivity coefficients of ion-selective electrodes

CO5: Students can describe the operation principles for biosensors and give examples of their applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**M**	**H**	**H**	**L**	**M**	**H**	**M**	**M**	**L**	**L**	**H**
CO2	**H**		**H**	**H**	**L**	**M**	**H**	**M**	**M**			**H**
CO3	**M**	**M**	**H**	**H**	**L**	**M**	**H**	**L**		**L**	**M**	**H**
CO4	**M**		**L**	**H**	**L**	**L**	**L**		**L**		**M**	**L**
CO5	**M**	**M**	**L**	**M**	**L**	**L**	**H**	**L**	**L**	**H**	**L**	**L**

H = Highly Related; M = Medium; L = Low