SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Biotechnology	LP: BT BT22056 Rev. No: 00 Date: 20.01.2025
B.E/B.Tech/~~M.E/M.Tech~~ : **Biotechnology** Regulation:2022 PG Specialisation : NA Sub.Code/Sub.Name **: BT22056/BIOSENSORS FOR AGRICULTURE AND FOOD SAFETY** Unit : I	

UNIT I Introduction to Biosensors 9

Overview of biosensor principles and classification; Historical development and evolution of biosensor technology; Fundamentals of transduction mechanisms (e.g., electrochemical, optical); Biosensor components and fabrication techniques; Applications of biosensors in agriculture and food safety; Hybrid sensors incorporated with AI for agriculture application; Advantages and limitations of biosensors compared to traditional analytical methods; Global market trends and forecasts for biosensor technology.

OBJECTIVE: To Understand the principles and components of biosensors and their applications in agriculture and food safety.

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Overview of biosensor principles and classification	TB1: Pg: 1-15	LCD/BB
2.	Historical development and evolution of biosensor technology	TB1: Pg:63-78	LCD/BB
3.	Fundamentals of transduction mechanisms (e.g., electrochemical, optical)	TB1: Pg:109-126	LCD/BB
4.	Biosensor components and fabrication techniques	TB1: Pg:17-61	LCD/BB
5.	Applications of biosensors in agriculture and food safety	TB1: Pg:213-255	LCD/BB
6.	Hybrid sensors incorporated with AI for agriculture application	TB1: Pg:213-255	LCD/BB
7.	Advantages and limitations of biosensors compared to traditional analytical methods	RB3: Pg: 24-37	LCD/BB
8.	Global market trends for biosensor technology.	TB1: Pg:299-311	LCD/BB
9.	Forecasts for biosensor technology.	RB3: Pg: 56-77	LCD/BB
Content beyond syllabus covered (if any):-			

* Session duration: 50 minutes

Sub. Code / Sub. Name : **: BT22056/BIOSENSORS FOR AGRICULTURE AND FOOD SAFETY**
Unit : II

UNIT II Biosensor Technologies for Agricultural Monitoring 9

Monitoring soil health and nutrient levels using biosensors; Detection of pesticides and agrochemical residues in crops and soil; Biosensors for monitoring plant pathogens and diseases; Remote sensing and IoT-enabled biosensor networks in precision agriculture; Detection of heavy metals and toxic contaminants in soil and water samples; Assessment of air quality and pollution levels in agricultural and rural areas; Biosensor-based methods for monitoring greenhouse gas emissions and climate change impacts; Nanomaterial-based biosensors for enhanced sensitivity and selectivity; Future directions and emerging trends in agricultural biosensor research and development.

OBJECTIVE:. To evaluate different transduction mechanisms used in biosensor technology and their suitability for specific applications.

Session No *	Topics to be covered	Ref	Teaching Aids
10.	Monitoring soil health and nutrient levels using biosensors	RB2: Pg: 3-15	LCD/BB
11.	Detection of pesticides and agrochemical residues in crops and soil	RB2: Pg: 137-169	LCD/BB
12.	Biosensors for monitoring plant pathogens and diseases	RB2: Pg: 169-191	LCD/BB
13.	Remote sensing and IoT-enabled biosensor networks in precision agriculture	RB2: Pg: 217-242	LCD/BB
14.	Detection of heavy metals and toxic contaminants in soil and water samples	RB2: Pg191-205	LCD/BB
15.	Assessment of air quality and pollution levels in agricultural and rural areas	RB2: Pg: 455-465	LCD/BB
16.	Biosensor-based methods for monitoring greenhouse gas emissions and climate change impacts	RB2: Pg: 435-455	LCD/BB
17.	Nanomaterial-based biosensors for enhanced sensitivity and selectivity	RB2: Pg: 3-15	LCD/BB
18.	Future directions and emerging trends in agricultural biosensor research and development.	RB2: Pg: 15-27	LCD/BB
Content beyond syllabus covered (if any):			

Session duration: 50 mins

Sub. Code / Sub. Name : **: BT22056/BIOSENSORS FOR AGRICULTURE AND FOOD SAFETY**
Unit : III

UNIT III Biosensors for Food Quality and Safety Assurance 9

Detection of foodborne pathogens (e.g., Salmonella, E. coli) using biosensors; Rapid screening of food contaminants (e.g., mycotoxins, allergens); Biosensors for allergen detection and labeling compliance; Authentication and traceability of food products using biosensors; Real-time monitoring of food processing and storage conditions; Emerging applications of biosensors in food safety; Regulatory considerations and standards for food biosensors

OBJECTIVE: To Analyze the role of biosensors in monitoring soil health, pesticide residues, and plant diseases in agricultural systems

Session No *	Topics to be covered	Ref	Teaching Aids
19.	Detection of foodborne pathogens (e.g., Salmonella, E. coli) using biosensors	TB3: Pg: 13-30	LCD/BB
20.	Rapid screening of food contaminants (e.g., mycotoxins, allergens);	TB3: Pg: 30-60	LCD/BB
21.	Biosensors for allergen detection and labeling compliance	RB1: Pg: 135-159	LCD/BB
22.	Authentication and traceability of food products using biosensors;	RB1: Pg: 177-191	LCD/BB
23.	Real-time monitoring of food processing	RB1: Pg: 211-227	LCD/BB
24.	Real-time monitoring of storage conditions	RB1: Pg: 211-227	LCD/BB
25.	Emerging applications of biosensors in food safety	RB1: Pg: 227-243	LCD/BB
26.	Regulatory considerations for food biosensors	RB1: Pg: 63-85	LCD/BB
27.	Standards for food biosensors	RB1: Pg: 111-135	LCD/BB

Content beyond syllabus covered (if any):

* Session duration: 50 mins

Sub. Code / Sub. Name : **: BT22056/BIOSENSORS FOR AGRICULTURE AND FOOD SAFETY**
Unit : IV

UNIT IV Challenges and Advances in Biosensor Development 9

Emerging trends in biosensor materials and nanotechnology; Signal amplification and enhancement techniques; Miniaturization and integration of biosensor platforms; Integration of Artificial intelligence to simulate conditions; Bioreceptor Engineering and Synthetic Biology; Multiplexed and high-throughput biosensor platforms; Regulatory considerations and standards for biosensor validation

OBJECTIVE: To Assess the effectiveness of biosensors in detecting foodborne pathogens, contaminants, and adulterants for ensuring food quality and safety.

Session No *	Topics to be covered	Ref	Teaching Aids
28.	Emerging trends in biosensor materials and nanotechnology	TB2: Pg: 177-221	LCD/BB
29.	Emerging trends in biosensor materials and nanotechnology	TB2: Pg: 249-275	LCD/BB
30.	Signal amplification and enhancement techniques	TB4: Pg: 27-49	Experiential learning
31.	Miniaturization and integration of biosensor platforms	TB4: Pg: 68-77	LCD/BB
32.	Integration of Artificial intelligence to simulate conditions	RB3:Pg: 24-66	LCD/BB
33.	Bioreceptor Engineering and Synthetic Biology	RB3:Pg: 67-89	LCD/BB
34.	Multiplexed and high-throughput biosensor platforms	RB3:Pg: 129-145	LCD/BB
35.	Regulatory considerations for biosensor validation	RB3:Pg: 224-236	LCD/BB
36.	Standards for biosensor validation	RB3:Pg: 224-236	LCD/BB
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

Sub. Code / Sub. Name : **: BT22056/BIOSENSORS FOR AGRICULTURE AND FOOD SAFETY**
Unit : V

UNIT V Applications and Case Studies 9

Case studies of biosensor applications in agriculture and food safety; Societal, ethical, and regulatory considerations in biosensor adoption; Interdisciplinary research and collaborations in biosensor development; Lab-on-a-Chip (LOC) Biosensors; Wearable Biosensors; Implantable Biosensors; Smartphone-based Biosensors; Quantum Biosensors.

OBJECTIVE: To Design and develop biosensor-based solutions for addressing agricultural and food safety challenges.

Session No *	Topics to be covered	Ref	Teaching Aids
37.	Case studies of biosensor applications in agriculture	TB5: Pg: 283-296	LCD/BB
38.	Case studies of biosensor applications in food safety	TB2: Pg: 383-415	LCD/BB
39.	Societal, ethical, and regulatory considerations in biosensor adoption	TB4: Pg: 145-165	LCD/BB
40.	Interdisciplinary research and collaborations in biosensor development	TB4: Pg: 185-209	LCD/BB
41.	Lab-on-a-Chip (LOC) Biosensors	TB1: Pg: 257-288	LCD/BB
42.	Wearable Biosensors	TB2: Pg: 48-135	LCD/BB
43.	Implantable Biosensors	TB2: Pg: 135-147	LCD/BB
44.	Smartphone-based Biosensors	TB2: Pg: 148-255	LCD/BB
45.	Quantum Biosensors	TB2: Pg: 257-286	LCD/BB

Content beyond syllabus covered (if any):

* Session duration: 50 mins

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TEXTBOOKS:

1. Jeong-Yeol Yoon, "Introduction to Biosensors", Springer-Verlag New York Ed., 2016.
2. Mohammed Zourob, "Recognition Receptors in Biosensors", Springer-Verlag New York Ed., 2010.
3. Turner, A.P.F., Karube, I. and Wilson, GS, "Biosensors: Fundamentals and applications", Oxford, U.K: Oxford University Press. 2007
4. S A Lima and M U Ahmed, "Introduction to Food Biosensors", The Royal Society of Chemistry, 2017.
5. Victor C. Yang, That T. Ngo, "Biosensors and Their Applications", Springer, 2012.

REFERENCE BOOKS:

1. Poonam Mishra, Partha Pratim Sahu, "Biosensors in Food Safety and Quality", 1st Edn. CRC Press, 2022.
2. Chittaranjan Kole, Ramesh Namdeo Pudake, Utkarsh Jain, "Biosensors in Agriculture: Recent Trends and Future Perspectives (Concepts and Strategies in Plant Sciences)", 1st Edition, Springer Nature, 2021.
3. Rushika Patel, "Biosensing: Methods, Applications and Technology", Nova Science Publisher, 2023.

	Prepared by	Approved by
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Designation	Professor	Professor & HOD
Date	20.1.2025	20.1.2025
Remarks *: The Same lesson plan will be followed in the subsequent year		
Remarks *: -		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD.