JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY

M.Sc. MICROBIOLOGY
(III SEMESTER)

2023-2024

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12BT116	**Semester** Odd	**Semester** 3 **Session** 2023 -2024
Course Name	Regulatory affairs		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Shweta Dang
	Teacher(s) (Alphabetically)	Dr Shweta Dang

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO120.1	Explain regulatory markets and agencies; preclinical and clinical trials	Understanding (Level 2)
CO120.2	Analyze the guidelines for approvals of new drugs/biologics	Analyzing (Level 4)
CO120.3	Compare innovator and generic pharmaceutical industry with Patent and Non patent exclusivity	Evaluating (Level 5)
CO120.4	Interpret ICH guidelines applicable to drugs and biotechnology based therapeutic products.	Understanding (Level 2)
CO120.5	Assess regulatory approvals via related case studies	Evaluating (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction To Regulatory agencies**	CDSCO, India USFDA, USA EMEA, Europian Union TGA, Australia	**2**
2.	**Introduction To Pharmacopoeias and Monographs**	Indian Pharmacopoeia (IP) British Pharmacopoeia (BP) United Sates Pharmacopoeia (USP) International Pharmacopoeia (Int. Ph.) European Pharmacopoeia (Eur. Ph.)	**2**
3.	**Safety and efficacy of drugs/biologics, preclinical studies, Clinical phases**	Case studies of safety issues in history, Preclinical requirements, acute and chronic toxicity, dose determination, NOAEL, phases of clinical trials (I,II III)	**4**
4.	**Approval pathways for Drugs/ biologic/ biopharmaceuticals in USFDA**	FDA,CDER, CBER, IND, NDA, BLA, recalls, Phase IV, filing procedures	**7**
5.	**Approval pathways for Drugs/ biologic/ biopharmaceuticals in europe**	EMEA, market authorization application. Centralized, Decentralized, National, Mutual recognition procedure. CTD, eCTD, Nees Submissions, ICH M4	**4**

6.	**Approval pathways for Drugs/ biologic/ biopharmaceuticals in India and Japan**	Central Drug Standard Control Organization, INDIA, Pharmaceutical and Medical Devices Agency of Japan	**3**
7.	**Generics and Biosimilars**	Hatch Wax man Act (Para I,II,III and IV filings), BPCI act USA, CDSCO guildines, EMEA guidelines, Status of guidelines	**6**
8.	**Non Patent Exclusivities**	Orphan Drug law, Market exclusivity, Pediatrics exclusivity, First to file exclusivity	**5**
9.	**ICH Guidelines for Biologics and Good Clinical Practices**	Overview of ICH guidelines, ICH QSEM, ICH Q5 ,Q6,. ICH E6, ICH Q8,9,10	**5**
11.	**Case Studies**	Relevant Case studies	**4**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test, Assignment I and II)
Total	**100**

PBL: To find approved drug molecule and find its patent and non patent exclusivity from Regulatory websites

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	FDA Regulatroy Affairs, David Mantos, Taylor and Francis; 2014 (3rd edition)
2.	Biosimilars Regulatory, Clinical, and Biopharmaceutical Development **Editors: Gutka, Hiten J., Yang, Harry, Kakar, Shefali , Springer 2018**
3.	The Common Technical Document (CTD), Internet: http://www.ich.org/
4.	ICH Guideline: The Common Technical Document for the Registration of Pharmaceuticals for Human Use: Quality - M4Q; Quality Overall Summary of Module 2, Module 3: Quality, Internet: http://www.ich.org/MediaServer.jser?@_ID=556&@_MODE=GLB

Subject Code	19M21BT212	**Semester:** Odd	**Semester:** III **Session :** 2023 -2024 **Month from:** July to December
Subject Name	**Recombinant DNA Technology**		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**: 1. Dr. Pooja Choudhary
	Teacher(s) (Alphabetically): 1. Dr. Pooja Choudhary 2. Dr. Shalini Mani

	COURSE OUTCOMES	**COGNITIVE LEVELS**
C230.1	Summarize the fundamental concepts of RDT, cloning vectors, prokaryotic vs. eukaryotic hosts and expression systems	**Understand Level, C2**
C230.2	Illustrate different methods of gene transfer, cloning, genomic libraries and molecular tools for microbes, plants and animals	**Apply level, C3**
C230.3	Analyse RDT tools, techniques and its applications in environment, Medicine and agriculture	**Analyze level, C4**
C230.4	Identify importance as well as ethical and biosafety issues related to transgenics	**Understand Level, C2**

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	**Introduction**	Basic Concepts of Recombinant DNA technology, origin of RDT, pioneering discoveries and significance of tailoring microbes, model plants and animals in present context	4
2.	**Enzymes, Vectors and Hosts for Cloning**	Restriction enzymes and other DNA modifying enzymes; Cloning vectors, expression vectors, prokaryotic and eukaryotic expression systems, bacterial, fungal and plant hosts for cloning, methods of gene transfer	6

	3.	**Recombinant DNA**	Basic techniques of gene manipulation, - Gel electrophoresis, DNA transformation techniques, Cloning	6
		Technology	of PCR products, Construction of Genomic and cDNA libraries, Screening Libraries with Gene Probes, Screening Expression Libraries, Positional Gene Cloning, Subtractive cloning, Functional cloning	
	4.	**Molecular tools supporting RDT**	PCR, RT-PCR, Blotting techniques, Sequencing methods, NGS, Gene editing, Mutagenesis, Gene expression techniques, Regulation of gene expression, microRNAs, Microarrays	4
	5.	**Methods & Applications of Plant Genetic engineering**	Molecular Biology of DNA transfer in Plant through *Agrobacterium tumefaciens*, methods for artificial gene transfer, Applications in agriculture such as golden rice, BT Cotton, Nif and Nod gene clusters and Nitrogen fixing, etc.	5
	6.	**RDT for Environmental Biotechnology**	Environmental Applications: biodegradation and bioremediation Energy based applications: Biogas, biodiesel and bioethanol production by microorganisms. Biotechnological applications. Biotechnological applications.	5
	7.	**RDT in Medicine & Therapeutics**	Production of recombinant vaccines and antibiotics, phytopharming, microbes as cell factories for production of therapeutic molecules, insulin and other major discoveries, gene therapy	6
	8.	**Animal cloning & Issues**	Transferring gene in animal oocytes, eggs embryos and specific animals tissues, Application of rDNA technology in animal cell lines, tailoring model animals, Controlling the expression of transgene in time and space, case studies exposing risks of animal cloning	4
	9.	**Ethics & Biosafety in RDT**	Ethical issues, Biosafety guidelines and regulations	2
	Total number of Lectures			**42**

PBL Component (C230.3): Students assigned topics in group of 2 to 3 members. A review of literature-based project on latest advancements in Recombinant DNA Technology and

genetic engineering. PBL involves real-time learning based on published scientific papers, involves constructive analytical thinking and peer learning. Students submit their report/e-poster/PowerPoint presentation of their review work.

Evaluation Criteria:

Components Maximum Marks

T1 20
T2 20
End Semester Examination 35
TA 25

Total 100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Genes XII: Benjamin Lewin, 2016
2.	Molecular Biology of the Gene, Seventh Edition: James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, 2004 Microbial Biotechnology: Progress and Trends, FarshadDarvishiHarzevili, Hongzhang Chen, First edition CRC Press/Taylor & Francis Group, 2017
3	Molecular biotechnology : principles and applications of recombinant DNA / Bernard R. Glick and Jack J. Pasternak, Cheryl L. Patten. ASM Press
4.	Gene Cloning and DNA Analysis: An Introduction, Seventh Edition-T. A. Brown, John Wiley & Sons Ltd. 2016
5.	Microbial Biotechnology: Progress and Trends, FarshadDarvishiHarzevili, Hongzhang Chen, First edition CRC Press/Taylor & Francis Group, 2014

Detailed Syllabus

Course Code	19M21BT211	**Semester :** ODD	**Semester: III** **Session:** 2023 -2024 **Month from:** July to December
Course Name	Food and Dairy Microbiology		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Dr. Smriti Gaur
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain the interactions between microorganisms and food environment.	**C2**
CO2	Illustrate the role of microorganisms in spoilage of food and dairy products with associated diseases.	**C2**
CO3	Analyze the effects of fermentation on quality of the dairy and non dairy products.	**C4**
CO4	Examine food preservation, safety and quality control.	**C4**
CO5	Identify applications of food and dairy Microbiology	**C3**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Food and microorganism**	Food as substrate for microorganism, Microorganisms important in food and dairy microbiology; Mold yeast and bacteria, Factors influencing microbial activity	05
2.	**Food Spoilage and Food borne diseases**	Contamination of food, general principles underlying spoilage, Spoilage of various foods and food products; cereals and cereal products, bakery products, dairy products, meat poultry and sea foods, Eggs, vegetables and fruits, sugar and sugar products,	10

		Microbiological examination of milk and milk products, source of their contamination and control, Food borne diseases: *Staphylococcal, E.coli, Salmonellosis, Shigellosis, Listerial* infections, Mycotoxins.	
3.	**Food Preservation & Principles**	General principles of food preservation, pasteurization of milk, Preservation by use High Temperature,Low temperature, drying, food additives, radiation, High-Pressure Processing Pulsed Electric Fields, Aseptic Packaging , Manothermosonication,	10
4.	**Fermented food**	Microbiology of fermented food products, traditional fermented food items like beverages (cereal and fruit juice based), bakery, fermented Vegetables and dairy products (cheese, yoghurt, fermented milk, cultured buttermilk, Kefir)	06
5.	**Food safety and control**	Microbiological quality standards of food, FDA, HACCP, ISI.	05
6.	**Applications of Food Microbiology**	Functional food, Intestinal Beneficial Bacteria-Concept of Prebiotics and Probiotics, Genetically modified foods, Biosensors in food, Milk as a source of bioactive peptides	06
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project based learning: Each student will opt a topic based on applications of food Microbiology. They will present and discuss in detail about the topic. This will enhance the student's understanding about various application aspects of food and dairy microbiology. They will get an insight into how different microorganisms can be employed for food and dairy based applications.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Food Science & Food Biotechnology, G.F.G Lopez and GVB Canovas CRC Press, Florida(2003)
2.	Bioprocess and Biotechnology for functional foods and Nutraceuticals, J.R Neeser , J.Bruce German Marcel and Dekker , New York (2004)
3.	Food Microbiology, Frazier W C, Westoff DC, Vanitha NM, Mc Graham Hill Education (2013)
4.	Fundamental Food Microbiology, 3rd edition by B. Ray., CRC press, (2006).
5.	Food Microbiology by M.R. Adams, Royal Society of Chemistry, (2008).

DIAGNOSTIC MICROBIOLOGY
Detailed Syllabus
Lecture-wise Breakup

Subject Code	19M22BT211	**Semester** **Odd 2023**	**Semester** 3rd **Session** 2023-24 **Month from** August **to** December
Subject Name	Diagnostic Microbiology		
Credits	**3**	**Contact Hours**	**3 + 1**
Faculty	**Coordinator/Teacher**	Dr. Rajnish (CC), Dr. Sonam Chawla	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Interpret the fundamental concepts, tools and methods of microbial diagnostics in relation to various human diseases/disorders	**Applying level (Level III) C3**
CO2	Apply principles of Molecular diagnostics to genetic counselling, communicable, non-communicable and lifestyle diseases/disorders	**Applying level (Level III) C3**
CO3	Correlate different advances in microbial diagnostics to human microbiome, their significance in disease management and therapy	**Analysis level (Level IV) C4**
CO4	Identify importance as well as ethical and biosafety issues related to the field of diagnostics	**Understanding Level (Level II) C2**

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Fundamentals of Microbial diagnostics and its significance in post genomic era in health care industry	03
2.	Microbiological diagnostic tools for bacterial pathogen detection	Microscopy and other culture based tests, Blood and other body fluids based biochemical methods for pathogen detection, strategies for antimicrobial sensitivity testing, Urea Breath Tests for *Helicobacter pylori*	08
3.	*Advanced Techniques in Diagnostic Microbiology*	Principles and characteristics of techniques ranging from rapid antigen testing, to advanced antibody detection, *in vitro* nucleic acid amplification techniques, Gene and signal amplification techniques, non-PCR mediated target amplification, RT-PCR and microarray based Identification, probe technologies, FISH, RFLP, RNA inhibition analysis, OLA, DNA finger printing	10
4.	Diagnostics for assessing viral infections	Methods in basic virology, Human Immunodeficiency Virus (HIV), Hepatitis C, B & A Virus, Covid and emerging microorganism detection and genotyping	04
5.	Diagnostic tools for Genetic counseling and Cytogenetics	Genetic analysis for inherited disorders, mutation detection, detection of allelic diversity (SSCP/DGGE/ DHPLC, PTT tests), Heterozygote Testing, Presymptomatic Testing, Prenatal Testing, and Newborn Screening	05

6.	Lifestyle diseases/disorders, Human microbiome	Human microbiome and Cancer, sequence-based gut microbial identification and applications in disease management and therapy	06
7.	Applications in Health care & Forensics	Diagnostic tools applicable in Hemoglobinopathies, Plasmapheresis, Blood Banking, blood and blood product screening forensics & Quarantine	04
8.	Regulatory, Ethical and biosafety issues in diagnostics	Laboratory safety and specimen management, regulatory controls, case studies related to ethics in diagnostics	02
		Total number of Lectures	42

Project Based Learning (PBL): Students will present recent advancement in diagnostics in class presentations, followed by a discussion on comparison of advancement with previous technologies and the benefit of the said advancement in terms of ASSURED criteria.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**Tang**, Yi-Wei, **Stratton**, Charles W. (Eds.), "Advanced techniques in Diagnostic microbiology", 2018, Springer publication
2.	Bailey & Scott's Diagnostic Microbiology, 14th Edition, **by Patricia Tille, 2017, Elsevier Evolve**
3.	Jean-Louis Serre, "Diagnostic techniques in Genetics", 2006, John Wiley & Sons publication
4.	Trent R J, "Molecular Medicine : An Introductory text", Churchill Livingston publication
5.	Refereed papers from scientific journals for case studies

Course Code	19M21BT213	**Semester** Odd	**Semester: III** **Session:** 2023-24 **Month from: July to December**
Course Name	Bioinformatics and Omics		
Credits	3	**Contact Hours**	**3**
Faculty (Names)	**Coordinator(s)**	Dr. Nidhi Batra	
	Teacher(s) (Alphabetically)	Dr. Nidhi Batra	

COURSE OUTCOMES: Upon completion of the course, students will be able to		**COGNITIVE LEVELS**
C112.1	Overview of the bioinformatics methods and resources	Understanding Level C2
C112.2	Explain about the Sequence analysis and highthotuput methodologies	Understanding Level C2
C112.3	Apply Genome annotation and proteome analysis in solving biological problems.	Apply Level C3
C112.4	Analyzing the use of Phylogenetic analysis in Microbial System annotation	Analyze Level C4

Course Description

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Overview of bioinformatics and Microbial Informatics	Introduction to Bioinformatics, Information flow, Scope of Bioinformatics, computers and microbes, basics of internet, Network-based services (Cloud & Grid Computing), microbial informatics, environment and diversity	5
2.	Biological databases, microbial genomes Projects	Basics of Database designing and modeling, Designing policies, File formats (FASTA, PIR, Genbank), data storage, retrieval, *Microbial* Genomes, Genbank,	5

		Pfam, KEGG, Brenda, MBGD, *biodiversity databases*	
3.	Sequence analysis (Sequence, retrieval, methods, substitution matrices, submission and analysis)	String comparison (substring, subsequence), Hamming and Levenshtein distance, Sequence alignment (pair wise, multiple) Dot plot method, Dynamic programming, *Needleman–Wunsch* and *Smith–Waterman* algorithm, BLAST algorithm ,FASTA algorithm comparison, PSI blast, gap penalty, e-value, statistical importance, PAM and BLOSUM matrices, log odd score, Sequence submission tools (Banklt, Sequin)	8
4.	High throughput data generation and analytics (NGS and Microarray)	Genome sequencing projects, NGS generation, Computational tool and pipelines, microarray technology, data analysis methods and tools	5
5.	Genome annotation procedures and analysis tools	Gene structure, Gene finding strategies Glimmer, Genscan, promoter region identification, promoter signals, genome annotation tools, Gene ontology, biological networks	4
6.	Protein Structure prediction and proteome analysis	Protein sequence and structures (primary, secondary and tertiary) and prediction, protparam, *Chou–Fasman*algorithm, GOR method, Concepts of structural modeling and tools (Comparative homology modeling, Threading), PHD, ANOLEA, Transmembrane protein prediction tools, Mass spectrometry data and analysis	6
7.	Phylogenetic analysis	Phylogeny, Phylogenetic reconstruction distance matrix, types of trees, Rooted un-rooted, distance based methods (UPGMA, FM, NJ Methods), Character based methods (Parsimony method, Maximum likelihood method), tree evaluation, (bootstrapping, Jackknifing), functional inferences. Phylogenetic profiles.	5
8.	Microbial System biology, Environment, and Metagenomics	System biology, microbial diseases. Metagenomics, Environmental *Informatics and health*	4

Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1, MCQ, PBL)
Total	**100**

PBL: Students will choose any protein prediction and proteome analysis tools to solve the biological problem linked to a particular disease. How is it commercially used asa therapeutic molecule or as a target to manage the disease? The understanding of proteins is required for Biotechnology companies including patent firms.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Attwood T.K. & Smith Parry., "Introduction to Bioinformatics", Benjamin Cummings, 2001
2.	BaxevanisA., D & Ouellette "Bioinformatics A practical guide to analysis of genes and protein", Wiley-Interscience, 1998.
3.	David Mount "Bioinformatics: Sequence and Genome analysis", Cold Spring Harbor Laboratory Press, 2001.

Course Name & Code: **Microbiology Lab III (**19M25BT211), NBA Code: C270

Semester III (Odd)

Course Code	19M25BT211	**Semester** Odd	**Semester** III **Session** 2023-24 **Month from** July to December
Course Name	Microbiology Lab-III		
Credits	4	**Contact Hours**	8

At the completion of the course, students will be able to,

S. No.	DESCRIPTION	COGNITIVE LEVEL (BLOOM's TAXONOMY)
C270.1	Apply concepts of food microbiology	Apply level (C3)
C270.2	Analyse bacterial transformation techniques	Analyze level (C4)
C270.3	Evaluate cloning techniques	Evaluate level (C5)
C270.4	Apply bioinformatics tools for microbial genome analysis	Apply level (C3)

Module No.	Title of the Module	List of Experiments
1.	**Food microbiology**	Enumeration of yeasts and moulds in food; microscopic examination of moulds; microbial standards for different foods and drinking water
2.	**Food adulteration**	Food adulteration: methods of detection of common adulterants in food, heat preservation of food; food fermentations (PBL: To produce novel/indigenous fermented food products)
3.	**Bacterial identification & diversity studies**	Use of Bioinformatics tools, marker genes & phylogenetic analyses for species identification and study of diversity
4.	**Comparative Omics**	Computational tools for Gene, Genome and Proteome analysis of microbes of interest; Network studies

PBL: To produce novel/indigenous fermented food products

Detailed Syllabus
Lecture-wise Breakup

Course Code	**17M12BT118**	**Semester** **Odd (MSc Micobiology 111)**	**Semester . III. Session** 2023-2024 **Month from** July – Dec 2023
Course Name	**Product Development in Biotechnology**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. Neeraj Wadhwa
	Teacher(s) (Alphabetically)	Prof. Neeraj Wadhwa

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Outline various processes relevant for Biobusiness	**Understand Level (C2)**
CO2	Compare marketing techniques and related ethics	**Apply Level (C2)**
CO3	Select appropriate technology for the production of Biological products	**Understand Level (C3)**
CO4	Explain financial, regulatory, health policy aspects for biobased industries	**Understand Level (C2)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Biotechnology Industries overview**	Biotechnology as a function of science and business , Functional units Company structure and functions Emerging technology and technical convergences issues	**5**
2.	**Business in the context of biotechnology** **Entrepreneurship-**	Science/development, the idea and its development Plant tissue culture lab-equipment- glasswares chemical requirement construction,techniques in culturing and export abroad, Vermitechnology, Mushroom cultivation, single cell protein, Biofertilizer technology-production, Textile processing, leather treatment, leather industry set up Detergent industry, bakery, Unit processes in food industry	**14**
3.	**Product development**	a. Production of commercially important primary metabolites like organic acids, amino acids and	**12**

		alcohol & Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids. b.Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers, Pulp and Paper , SINGLE CELL PROTEIN & Mushroom culture, Bioremediation. Bioprocess strategies in Plant Cell organ culture and Animal Cell culture.	
4.	**Biobusiness plans**	Concerns and oppurtunities, Environmental clearances requirement from government, Quality checks and validation certificates, Packaging concerns, Policy and regulatory concerns,	**6**
5.	**Bioremediation Bioethics and legal issues**	Product development, Sustainability, Environmental concerns of product and their waste.	**5**
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.
2.	Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House.
3.	Cruger,Wulf and Anneliese Crueger, “Biotechnology: A Textbook of Industrial Microbiology”, 2nd Edition, Panima Publishing, 2000
4	Karthikeyan,S and Arthur Ruf.” Biobusiness”MJP Publication Chennai India 2009

Biosensors(17M12BT111)
Course Description

Course Code	17M12BT111	**Semester** Odd	**Semester MSc/Integ. Mtech** III/VII **Session** 2023-2024 **Month from:** July-December
Course Name	Biosensors		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof.Sudha Srivastava
	Teacher(s) (Alphabetically)	Prof.Sudha Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain principle and working of biosensors and characterization techniques	Understand Level(C2)
CO2	Evaluate different methods of immobilization and their effect on biosensor performance	Evaluate Level (C5)
CO3	Analyze performance of a biosensor for disease diagnosis, environmental pollution, pathogen quantification	Analyze Level (C4)
CO4	Design strategy for fabrication of a given biosensor with high sensitivity and wide detection range	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction:**	Sensors and biosensors, definitions, types of sensors, markets, target analytes, glucose and other medical sensors	2
2.	**Biosensor Advancements and nanotechnology**	First-, second-, third generation biosensors, Nanotechnology and present day biosensors	3
3.	**Basic Design Considerations**	Calibration, dynamic Range, signal to noise, sensitivity, selectivity, interference.	3
4.	**The biological component**	Whole cell sensors, enzymes – sensing substrates or inhibitors, antibodies (Mab, Fab). And other binding proteins, oligonucleotides and aptamers.	3
5.	**Types of biosensors**	Optical biosensors, Electrochemical biosensors, Piezoelectric biosensor, Calorimetric biosensors	8
6.	**Immobilization method**	Non-covalent immobilization - entrapment and multipoint electrostatic attachment. Covalent attachment via thiol, amino and hydroxyl groups.	4

		Affinity interactions - avidin/biotin, , complementary oligonucleotides.	
7.	**Techniques for sensing : Physical and chemical**	Absorbance, fluorescence, chemi/bioluminescence and phosphorescence, Surface Plasmon Resonance (SPR), quartz crystal microbalance, cyclic voltammetry	8
8.	**Sensor stabilization**	Storage and operational stability. Polyols, polymers and low Mw compounds as stabilizing agents for drying and long term storage. Stabilization mechanisms.	3
9.	**Applications**	Pharmaceutical**,** agricultural, food safety, biomedical applications, food processing: state of the field, market potential, unique design criteria and needs, current sensors in use.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test, Presentation)
Total	**100**

PBL: Students would be presenting and/or submit report in a group of 3-4, about biosensors for various application , their fabrication, performance characterization.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Ligler, F.S. and Rowe Taitt, C.A. 2002. Optical Biosensors: Present & Future. Elsevier, The Netherlands. ISBN: 0-444-50974-7.
2.	Yang, V.C. and T.T. Ngo. 2000. Biosensors and Their Applications. Kluwer Academic/Plenum Publishers, New York, NY. ISBN: 0-306-46087-4.
3.	Recent research articles