

Syllabus

Certificate Course on Types of Electrophoresis – Techniques and Troubleshooting

ORBITO ASIA DIAGNOSTICS

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Affiliated to



BHARATHIAR UNIVERSITY

(A state University, Accredited with “A” Grade by NAAC,
Ranked 13th among Indian Universities by MHRD- NIRF,
World Ranking: Times – 801 – 1000, Shanghai – 901 -1000,
URAP -982)

Coimbatore – 641 046, Tamil Nadu, India

2022 – 2023 Onwards

About Us:

Orbito Asia Diagnostics is a comprehensive healthcare facility for imaging and diagnostic facilities, under one roof with NABL, NABH & ISO accreditation. We are one of the largest COVID RT PCR testing laboratory with the capacity of >25000 tests per day with fully automated robotic liquid handling systems. It prides of housing the latest infrastructure, the best possible medical facilities, accompanied with the most competitive prices and thorough individual care so that the customer can have the diagnostic tests done at the most efficient and cost effective means at a single point by our experienced and certified doctors and friendly supportive staff. We strive to provide ultimate diagnostic services to our clients with accurate results, highest quality imaging and comprehensive health check-up services with complete care, courtesy and compassion to our customers. Orbito Asia provides diagnostic solutions that improve patient health and ensure consumer safety. Orbito Asia is determined to continue to play a pioneering role by innovating and designing the diagnostics of the future to address the major challenges for public health. Orbito Asia offers more than 300 different tests and special profiles in pathology and diagnostic and scan services. With more than 20 collection centres across the state, our diagnostic services are unsurpassed. We believe one of the most important facets of being an outstanding reference laboratory is the quality assurance we provide in every result.

Program Highlights:

- This certification course of 3 months is designed to fulfil the need for highly skilled and trained technical in Hybridoma and Electrophoresis Techniques for the enhancement in diagnostic and research purposes.
- This practical enhanced curriculum is delivered through lectures by the renowned faculty of Orbito Asia Diagnostics and various enhanced in-house practical techniques.
- Regular theory and practical sessions will be conducted along with seminars carried out by Ph.D.'s and Research scholars from Molecular Division.
- Experiential learning at Orbito Asia Diagnostics and case studies conducted by experienced technical staffs helps the students deepen their knowledge about Hybridoma and Electrophoretic techniques carried out in the laboratory and pharma based industries.
- The course is associated with department of Biotechnology – Bharathiar University for guest lectures and higher end Practicals using their advanced facility with the help of the distinguished faculty members of the department.

Eligibility:

- B.Sc/M.Sc (Molecular biology, Microbiology, Biochemistry and Allied sciences)
- B.Tech/M.Tech (Biotechnology and Allied science)
- MBBS/MD
- Candidates working in a clinical lab, hospital, academic/research institution, Pharmaceutical, Food industry and any health sector with an interest to learn Application of Hybridoma and Electrophoresis Techniques in with a minimum graduation degree.

Year	Subject Code	Title of the course	Hours/ Week
2022 -2023 onwards	22TETT	Types of Electrophoresis – Techniques and Troubleshooting	25

Program Educational Objectives (PEOs):

This objective of this programme is to develop qualified molecular biologists with the following competencies.

PEO 1: To prepare competent graduates for careers in molecular and genetic related fields

PEO 2: To provide a scientific foundation for expertise in the field of genetics and pharmaceuticals

PEO3: Interpreting the detailed procedure of electrophoresis, quantification, troubleshooting, hybridoma techniques and its approach in clinical and research fields.

Program Outcomes (POs):

On completion of the certificate course on Application of hybridoma and Electrophoresis techniques in Diagnostics and Research, the participants will be able to

PO 1: Understand the basics of electrophoresis and its types.

PO 2: Provide a detailed knowledge of how to quantify proteins and preparation of reagents for electrophoresis

PO 3: Provide theoretical knowledge of different types of electrophoresis, staining procedure and the analysis of the data obtained

PO 4: Provides information about how the monoclonal antibodies are produced, its function and its approach in therapeutics

PO 5: Provide knowledge in troubleshooting of the electrophoresis techniques, its clinical approach and Next Gen Sequencing.

Assessment Criteria:

Sr. No.	Guidelines for Assessment
1.	A combination of theory and practical courses will be offered in this certificate course. The courses will be offered with 60% practical and 40% theory.
2.	Duration : 3 months
3.	CREDIT: 20
4.	Grade and examination pattern: Semester pattern (both internal and external) as per the Bharathiar University Examination norms
5.	Evaluation: As per the Bharathiar University Examination norms
6.	Certificate: Based on the report of the post – training assessment jointly conducted by Bharathiar University and Orbito Asia Diagnostics

Certificate Course on Types of Electrophoresis – Techniques and Troubleshooting

S.No	Subject	Hours		Exam		Total marks	Credits
		T	P	CIA	ESE		
Course Duration – 3 months							
Lecture							
Application of Electrophoresis Techniques							
1	Introduction of Electrophoresis	90	-	50	50	100	6
2	Protein quantification, Reagents and equipment						
3	Types of Electrophoresis						
4	Hybridoma Techniques						
5	Troubleshooting and clinical application						
Practical							
6	Thin Layer Electrophoresis	105	50	50	100	7	
	Cellulose acetate electrophoresis						
	Agarose Gel Electrophoresis [AGE]						
7	SDS-Polyacrylamide Gel Electrophoresis [PAGE]	105	50	50	100	7	
	2D Gel Electrophoresis						
	Immunoelectrophoresis						
	Capillary Electrophoresis						
Total		90	210	150	150	300	20

CIA continuous Internal Assessment

ESE End Semester Examination

Year	Course Code	Title of the paper	L	T	P	C
2022 -2023 onwards	22TETT01	Application of Electrophoresis Techniques	5	5	-	6

Course Objectives:

The main objectives of this course are to:

1. Make students understand the basics of Electrophoresis techniques
2. Make students understand the importance of Electrophoresis techniques and protein quantification
3. Inculcate knowledge about various types of electrophoresis
4. Provide an in-depth knowledge about hybridoma techniques
5. Make students learn the troubleshooting of electrophoresis instruments and its clinical approach

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basics of Electrophoresis techniques	K1 & K2
2	Understand the importance of Electrophoresis techniques and protein quantification	K1 & K2
3	Learn various types of electrophoresis	K1 & K2
4	Knowledge about hybridoma techniques	K1 & K2
5	Learn the troubleshooting of electrophoresis instruments and its clinical approach	K1 & K2

K1 – Remember; **K2** – Understand; **K3** – Perform; **K4** - Analyse

Subject code	22TETT01	Application of Electrophoresis Techniques
Unit:1	Introduction to electrophoresis	20 hours
Introduction ; History of electrophoresis and iontophoresis ; Electrophoresis techniques ; Moving boundary electrophoresis ; Zone electrophoresis		
Unit:2	Protein quantification ,Reagents and equipment	20 hours
Methods of protein quantification ; Protein determination by UV absorption ; The Bicinchoninic Acid (BCA) assay ; Bradford method ; Biuret assay ; Folin – Lowry Assay ; Flow cytometry ; Buffers and Reagents preparations ; Gel casting ; Equipments ; Horizontal and vertical electrophoresis systems ; Recipes for electrophoresis solutions		
Unit:3	Types of electrophoresis	20 hours
Introduction ; Thin layer electrophoresis ; Cellulose acetate electrophoresis ; Agarose Gel Electrophoresis; SDS-Polyacrylamide gel electrophoresis (SDS-PAGE) ; Principle ; Materials ; Procedure ; Future directions ; 2D gel electrophoresis ; Immuno electrophoresis ; Capillary electrophoresis ; Principle ; Isoelectric focusing ; Materials ; Procedure ; Result analysis ; Advantages ; Limitations; Introduction ; Protein blotting methods ; Types of Staining ; Identification, detection and visualization ; Materials and reagents ; Blot detection ; Data analysis		
Unit:4	Hybridoma techniques	20 hours
Introduction ; Principle ; Immune system; Innate and Adaptive Immune system; Complement system; MHC molecules; Monoclonal antibodies; Therapeutic approach of Monoclonal antibodies; Polyclonal antibodies; Nucleotide synthesis pathway; Monoclonal Antibody therapy; Hypersensitivity and its types; Western immunoblotting;		
Unit:5	Troubleshooting: Clinical applications	20 hours
Factors affecting electrophoresis ; Protein solubilization ; choice of lysis buffer ; What is a valid result ; Data analysis ; Errors in electrophoresis techniques ; Determination of size and molecular weight ; Oligometric status of protein ; Protein interaction ; Detection of glycoprotein and phosphoprotein ; DNA analysis ; Next generation sequencing ; antibiotic testing ; Vaccine testing		
Total theory hours		100 hours
References		
<ol style="list-style-type: none"> 1. Principles and Techniques of Practical Biochemistry (5th Ed.), Wilson, K., Walker, J. (eds.); Cambridge University Press, Cambridge, 2000 2. Biochemistry Laboratory: Modern Theory and Techniques (2nd Ed.), Rodney Boyer (eds.), Prentice Hall, 2012 3. An Introduction to Microscopy, Suzanne Bell, Keith Morris (eds.), CRC Press, 2009 4. Fundamentals of Light Microscopy and Electronic Imaging (2nd Ed.), Douglas B. Murphy, Michael W. Davidson (eds.), Wiley-Blackwell, 2013 5. Dunbar BS. Two-dimensional electrophoresis and immunological techniques. Springer Science & Business Media; 2012 Dec 6. 		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	L	S
CO2	S	S	M	L	L
CO3	S	S	S	L	M
CO4	L	L	L	S	M
CO5	L	M	L	S	L

Year	Course Code	Title of the paper	L	T	P	C
2022 -2023 onwards	22TETTP01	Practical 1	-	-	3	7

Course Objectives:

The main objectives of this course are to give students hands on training in:

1. Make students to get knowledge of how to perform thin layer chromatography and its applications
2. Make students to get knowledge of how to perform Cellulose Acetate Electrophoresis and its applications
3. Inculcate knowledge about Agarose Gel Electrophoresis

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get knowledge of how to perform thin layer chromatography and its applications	K3 & K4
2	Get knowledge of how to perform Cellulose Acetate Electrophoresis and its applications	K3 & K4
3	Knowledge about Agarose Gel Electrophoresis	K3 & K4

K1 – Remember; **K2** – Understand; **K3** – Perform; **K4** - Analyse

Subject code	22TETTP01	Practical - I			
Unit:1					
Unit:1	Thin Layer Electrophoresis				35 hours
Planning and preparation of chemicals, Calculation of Rf value, 2D study of proteins and nucleic acids.					
Unit:2					
Unit:2	Cellulose Acetate Electrophoresis				35 hours
Planning and preparation of chemicals, Analysis of clinical and biological protein sample.					
Unit:3					
Unit:3	Agarose Gel Electrophoresis(AGE)				35 hours
Planning and preparation of chemicals, Analysis of DNA bands based on base pair size.					
Total					105 hours
References					
1.Thin-Layer Electrophoresis:Thin-Layer Chromatography, 1969 ISBN : 978-3-642-88490-0 K. Hannig, G. Pascher.					
2. Cellulose Acetate Electrophoresis: Techniques and Applications ; H. P. Chin Ann Arbor-Humphrey Science Publishers, 1970					
3. Electrophoresis in Practice: A Guide to Methods and Applications of DNA and Protein Separations, Fourth Edition; Dr. Reiner Westermeier,2004					

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	L	M
CO2	S	S	S	L	M
CO3	S	S	S	L	M

Year	Course Code	Title of the paper	L	T	P	C
2022 -2023 onwards	22TETTP02	Practical - II	-	-	4	7

Course Objectives:

The main objectives of this course are to give students hands on training in:

1. Make students to get knowledge of how to perform SDS-PAGE and its applications
2. Make students to get knowledge of how to perform 2D-Gel Electrophoresis and its applications
3. Inculcate knowledge about Immuno-electrophoresis
4. Provide an in-depth knowledge about capillary electrophoresis technique

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get knowledge of how to perform SDS-PAGE and its applications	K3 & K4
2	Get knowledge of how to perform 2D-Gel Electrophoresis and its applications	K3 & K4
3	Knowledge about Immuno-electrophoresis	K3 & K4
4	Knowledge about capillary electrophoresis technique	K3 & K4

K1 – Remember; **K2** – Understand; **K3** – Perform; **K4** - Analyse

Subject code	22TETTP02	Practical - II			
Unit:1	SDS- Polyacrylamide Gel Electrophoresis (PAGE)			30 hours	
Planning and preparation of chemicals, Analysis of protein bands based on their charge and molecular mass.					
Unit:2	2D Gel Electrophoresis			25 hours	
Planning and preparation of chemicals, Analysis of protein bands based on their isoelectric point and molecular weight.					
Unit:3	Immuno electrophoresis			25 hours	
Planning and preparation of chemicals, Analysis of antigen- antibody interaction					
Unit:4	Capillary Electrophoresis			25 hours	
Planning and preparation of chemicals, Analysis of proteins, peptides, amino acids and nucleic acids.					
Total				105 hours	
References					
<ol style="list-style-type: none"> 1. SDS-Polyacrylamide Gel Electrophoresis (SDS-PAGE); Sean R.Gallagher; Current protocols essential laboratory techniques. 2. Cherry JP, Barford RA, editors. Methods for protein analysis. The American Oil Chemists Society; 1988. 3. Williams CA. Immunoelectrophoresis. Scientific American. 1960 Mar 1;202(3):130-44. 4. Baker DR. Capillary electrophoresis. New York: Wiley; 1995 Feb. 					

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	L	M
CO2	S	S	S	L	M
CO3	S	S	S	L	M
CO4	S	S	S	L	M