Rajiv Gandhi Institute of Veterinary Education and Research
Kurumbapet, Puducherry – 605 009

A Government of Puducherry Institution

Affiliated to Pondicherry University

1. **Title of the Short-Term course/programme:** Post Graduate Diploma in Molecular Diagnostics (PGDMD)

2. **Type of the course:** PG Diploma

3. **Department:** Centre for Translational Research (CTR), Rajiv Gandhi Institute of Veterinary Education & Research (RIVER), Puducherry-605 009

4. **Duration of the course:** One year (Hybrid)

5. **Start dates: (Month):** September of every Academic Year

6. **Details of Faculty associated with the course**

	Principal Faculty	**Co-Principal Faculty**
Name	Dr. V. M. Vivek Srinivas	Dr. J. Nikhil Kumar Tej
Designation	Assistant Professor, CTR	Assistant Professor, CTR
Contact No.	+91 97428 91992	+91 63044 78894
Email	vivekvet24@gmail.com	drnikhilkumartej@gmail.com

7. **Other Departments to be associated with conducting / supporting the Short-Term course:**

   - Department of Veterinary Microbiology, RIVER, Puducherry

   - Department of Veterinary Biochemistry, RIVER, Puducherry

8. **About the course**

   Molecular Diagnostics is the process of identifying a disease by understanding the molecules, such as proteins, DNA, and RNA, in a tissue or fluid, which form the markers of the disease directly or indirectly. Molecular diagnostics is a new discipline that captures genomic and proteomic expression patterns and uses the information to distinguish between two or more conditions at the molecular level. The conditions under investigation can be Infectious diseases or genetic diseases. Molecular diagnostics can be used in animals and plants, not just humans. Molecular diagnostics can also be used to identify foodstuffs, vegetables, meat types, food processing methods, etc., and can also be used in environmental monitoring to detect the presence of specific microorganisms in various samples, including food materials. The course will provide the theory and use of molecular techniques in diagnostics, placing more importance on nucleic acid-based methods. Molecular techniques and analytical techniques related to the development and use of diagnostics, such as polymerase chain reaction (PCR),

quantitative reverse transcriptase PCR (qRT-PCR), LAMP assay, hybridization techniques, microarray analysis, bioinformatics tools and immuno-chromatographic tools, will be emphasized.

The entire program/ course will be taught by highly qualified professionals and faculty members of CTR, RIVER who have expertise in various subjects (genomics, proteomics, microbiology, virology, parasitology, computational biology, and data analysis). This centre at RIVER has recently been established as a new molecular diagnostics technique facility equipped with advanced model instruments in PCR / Real-time PCR, Electrophoretic apparatus, Gel documentation system, Bioinformatics tools, etc., at Puducherry shall provide a platform for successfully running the hands-on session of the course. We plan to maintain a maximum annual intake capacity of fifteen undergraduates to maintain an appropriate teacher-student ratio. This would provide quality hand-holding so that our students are well placed in sectors such as hospitals, diagnostic labs, pharma industries, and R&D labs.

9. Scope of the Course

Molecular Diagnostics has revolutionized the healthcare system by providing rapid and timely diagnosis to ease the treatment modalities. An increase in the incidence of life-threatening diseases, like bacterial, viral, and fungal infectious diseases, primarily drives the high demand for molecular diagnosis. Hospitals, industries, and research centres account for the largest share of this market. This means an immediate need for trained professionals in the healthcare sector, including molecular diagnostics. Though the molecular diagnostic technologies in India are at par with global standards, we still need to provide skilled professionals who can efficiently use the available resources and technology. Therefore, to meet the demand for skilled, qualified professionals in the field of molecular diagnostics, we plan to introduce a new one-year practical -based PG diploma course on Molecular Diagnostics at the Centre for Translational Research (CTR), Rajiv Gandhi Institute of Veterinary Education & Research (RIVER), Puducherry.

10. Objectives of the Course

The course focuses on learning to provide systematic knowledge on the basics and principles of various molecular techniques for diagnosis and development, as well as troubleshooting for research and utilization in diagnosis.

11. Topics to be covered:

Module 1: Genetics and Genomics (12 hrs)
- Fundamentals of genetics; Structure of DNA, RNA and protein; DNA replication, transcription and translation processes
- Brief overview of prokaryotic and eukaryotic genome organization, Genome mapping, proteomic technologies, protein-protein and protein-DNA interactions

Module 2: Basic of Immunology and Molecular Biology (24 hrs)
- Immune cell types, cell cycle, cell death
- Determination of blood group & Rh typing; Concepts of FACS, IFA, LFIA, ELISA – types and applications
- Primer designing using bioinformatics tools; PCR – principle, optimization, trouble shooting, its types and their applications; Identification of gene and genome variations: PCR-based methods for genotyping - PCR-RFLP, ARMS, SSCP, Multiplex PCR; LAMP assay
- Introduction and tools for genetic engineering; Recombinant DNA technology
- Nucleic acid hybridisation methods – Southern, Western and Northern blotting; Restriction Mapping; Microarrays; Nucleic acid and protein sequencing
- Identification of molecular biomarkers for disease diagnosis - RFLP/VNTR/SSR or STR/SNP or SNV, etc.
- Emerging Technologies: CRISPR-Cas9 and gene editing; Single-cell sequencing; Molecular imaging

Module 3: Molecular Diagnostics Techniques (24 hrs)
- Basic laboratory practices: Learning the basics of laboratory safety, good laboratory practices, the dos and don'ts; principle and handling of laboratory equipment, handling of pipettes; centrifugation, autoclaving
- Preparation of buffers, reagents, stock and working solutions
- DNA and RNA extraction and isolation
- Quantitative (Nanodrop)/Qualitative (agarose gel electrophoresis) estimation of DNA
- Electrophoretic techniques - AGE/PAGE
- Gene amplification by Polymerase Chain Reaction (PCR)
- Sequencing and DNA sequence analysis and phylogenetic analysis using bioinformatics tools
- Real-Time PCR: SYBR Green-based and TaqMan probe-based technique, Absolute quantification
- Detection and identification of microorganisms using molecular techniques; Antibiotic resistance testing

Module 4: RNA & Protein based Expression techniques (20 hrs)
- ABO blood typing assay; Isolation of PBMCs from whole blood
- ELISA - Direct, Indirect, Sandwich and Competitive ELISA
- Immunohistochemistry
- RNA isolation, cDNA synthesis; Relative gene expression using qRT-PCR
- Protein extraction from cells /tissues; Protein purification
- SDS-PAGE
- Western blotting/Immunoblotting
- Immuno-chromatographic tools

Practical Session-I (In-person 30 hrs)

- Basic laboratory practices: Learning the basics of laboratory safety, good laboratory practices, the dos and don'ts; principle and handling of laboratory equipment, handling of pipettes; centrifugation, autoclaving
- Preparation of buffers, reagents, stock and working solutions
- DNA and RNA extraction and isolation
- Quantitative (Nanodrop)/Qualitative (agarose gel electrophoresis) estimation of DNA
- Electrophoretic techniques - AGE/PAGE
- Gene amplification by Polymerase Chain Reaction (PCR)
- Sequencing and DNA sequence analysis and phylogenetic analysis using bioinformatics tools
- Real-Time PCR: SYBR Green-based and TaqMan probe-based technique, Absolute quantification
- RNA isolation, cDNA synthesis; Relative gene expression using qRT-PCR
- Detection and identification of microorganisms using molecular techniques; Antibiotic resistance testing

Practical Session-II (In-person 30 hrs)

- ABO blood typing assay
- Isolation of PBMCs from whole blood
- ELISA - Direct, Indirect, Sandwich and Competitive ELISA
- Immunohistochemistry
- Protein extraction from cells /tissues
- Protein purification
- SDS-PAGE
- Western blotting
- Lateral flow Immunoassay

12. Outcome:

Successful completion of the research-based Molecular Diagnostic PG Diploma Course will ensure that students acquire:

- The basics and principles of applications of various molecular diagnostic methods

- Selection of an appropriate diagnostic method/tool for a particular disease condition and sample type

- Adequate knowledge of recent advances and technological developments in the field of diagnostics

- Practical knowledge of various diagnostic tools used in healthcare, industry, and research

- Expertise to perform any diagnostic test with an ability to troubleshoot

13. **Eligibility:**

The minimal eligibility for the students to enrol in the PG diploma course is to have Graduates, BVSC & AH degree or BSc degree in either of the following subjects; (a) Zoology, (b) Chemistry, (c) Biochemistry, (d) Microbiology (e) Life-Science/Bioscience, (f) Biotechnology, (g) Medical Laboratory Techniques (MLT) or BTech in Biotechnology with minimal 55% marks or equivalent grades.

14. **Curriculum:**

- ❖ 4 modules (Online) & 2 practical session (In-person) in One year (12 Months)

- ❖ Two hours of theory per week, online mode

- ❖ Practical component – In-person classes, two times, five days each – one in the middle of the year and another after completing 85% of the course duration. Attendance is compulsory. Exact dates will be intimated.

- ❖ Distribution of study material compulsory

- ❖ Evaluation:

Theory	Practical
• Continuous Assessment (20 Marks) – Submission of two response sheets – one in the middle of the year and another after 85% of course duration.	• Toward the end of the course duration for 100 marks ✓ Practical Exam – 70 marks ✓ Viva-Voce – 20 marks ✓ Record – 10 marks
• Final Examination (80 Marks) – In person examination at the end of year.	
• Examination pattern – Subjective questions for a three hour duration. ✓ Subjective (80 Marks) (16x5 marks – Sixteen out of twenty)	

- ❖ Weightage: Theory Vs Practical as per the credit load.

- ❖ Minimum marks for passing 50% (Theory plus Practical)

15. **Fee:** Rs. 25,000/- per annum