**PG DIPLOMA IN ENVIRONMENTAL MOLECULAR DIAGNOSTICS**

**(Non-Semester)**

**(With effect from the academic year 2013-14)**

**Eligibility for the Course**

Candidates for admission to PG Diploma In Environmental Molecular Diagnostics could posses a Bachelors degree in Zoology, Botany, Chemistry, Biochemistry, Microbiology Biotechnology/Environmental/ Animal/plant Food sciences, Dietetics & Nutrition, Bioinformatics, BE in Chemical Engineering & Biotechnology; B.Tech in Biotechnology & Bioinformatics/Nanotechnology; BDS; MBBS; B.Sc in Agri/Agri Biotechnology;B.V.Sc., B.F.Sc., .Pharm and BPT.

**Duration of the Course**

One year PG Diploma In PG Diploma In Environmental Molecular Diagnostics course non-semester for One Year duration

**Examination**

All the theory paper are of 3hours duration each for maximum of 100 marks with passing minimum of 50 marks Practical examinations are also for 3 hours duration for a maximum of 100 marks and passing minimum of 50 marks.

Question Paper Pattern

Maximum marks: 100 Time: 3 hours

Part A (5 x 3 = 15)

Five short answer questions (One question from each unit)

Part B (5 x 8 = 40)

Paragraph questions (Total questions 8, out of which answers are to be given for any five questions;

Part C (3x 15 = 45)

Total questions 5, out of which answers are to be given for any Three questions;

| S.No | Theory & Practicals | Maximum Marks | Minimum Marks |
|---|---|---|---|
| 1. | Environmental Micro Biology | 100 | 50 |
| 2. | Molecular Diagnostics | 100 | 50 |
| 3. | Environmental Forensics | 100 | 50 |
| 4. | Molecular Epidemology | 100 | 50 |
| P1 | Practical - I Molecular Diagnostics | 100 | 50 |
| P2 | Practical – II Molecular Diagnostics | 100 | 50 |

## PAPER- I ENVIRONMENTAL MICROBIOLOGY

### UNIT – I: Microorganisms

Classification of Organisms – Eubacteria: Cell Envelope, cytoplasm, Glycocalys, Appendages, and Endospores – Archaea: Archaean Habitats & Function – Fungi: Structure, Diversity & Ecological Considerations – Protozoa – Algae: Cell structure and considerations – Viruses: infective Nature of Viruses, prokaryotic & Eukaryotic viruses –Viroids – Prions – Bacterial Growth.

### UNIT – II: Microbial Environments

Earth Environments: Physicochemical characteristics of the Earth Environment – Distribution of Microorganism in Soil – Aeromicrobiology: Pathways – Bioaerosol Control – Aquatic Environment - Palanktonic Environment – Benthic habitat – Biofilms – Aquatic Microbes: Food for the future – Low & High temperature Environments – Acidic Environments.

### UNIT –III: Deduction, Enumeration and Identification

Microscopic Techniques: History, Light, Phase contrast, Fluorescence, Electron and Scanning probe microscopy imaging – cultural methods – Enumeration and Isolation techniques – Plating methods – Most probable Number Techniques – physiological methods: Carbon Respiration, Adenylate Energy charge – Enzyme assays –Functional Genomics and Proteomics based approaches – Immunological Methods: Polyclonal and Monoclonal Antibodies, Immunoassays, ELISA, Western blotting – Immunoprecipitaion assays – Nucleic acid – based methods: Extraction of Nucleic acids – Microarrays – PCR – Real Time PCR
– RFLP – Gel Electrophoresis - FISH

### UNIT – IV: Remediation of Organic and Metal Pollutants

Environmental Law – Toxicity – Biodegradability – Environmental factors affecting Biodegradation – Biodegradations of Organic pollutants – Metal Toxicity effects on the microbial cell – physicochemical methods of metal remediation

### UNIT – V: Water and Foodborne pathogens

Environmentally transmitted pathogens: Bacteria, Parasitology, Viruses – Fecal coliforms and *E. Coli* - Bateriophage – wastewater treatment and Disinfection: Primary, Secondary Tertiary treatment – Oxidation ponds – Drinking water treatment

### REFERENCES:


1. Raina M. Maier, Lan L. Pepper, Charles P. Gerba, Second Edition. Academic press, 2009. Environmental Microbiology.
2. Stuart walker, T. (1998). Microbiology. W.B. Saunders Co., USA.

## PAPER – II: MOLECULAR DIAGNOSTICS

### UNIT–I: MICROBIAL & VIRAL DIAGNOSTICS

Major microbial pathogen types: bacteria and viruses – Detection of infectious agents and molecular epidemiology: M. tb, HCV & HIV – Conventional Vs Molecular diagnostics: merits and demerits – Biological warfare: *Bacillus anthracis*, H5N1- Epidemics of chikengunya-Quarantin methods.

### UNIT II: MOLECULAR DIAGNOSTIS OF DISEASES

Gene polymorphism: candidate genes approach – Metabolic and genetic disorders: DNA analysis in Duchene Muscular Dystrophy –Sickle cell anemia and beta thalassemia- retinoblastoma- cystic fibrosis

### UNIT III: CANCER DIAGNOSTICS

Cancer diagnostics: Types of oncogenes – Molecular diagnostics of cancer markers-Tumor imaging and staging–Tumor suppression: mode of action and mutation in p53 –BRCA genes–Telomeres and Cancers- Leukemias: Microarray based diagnostics.

### UNIT IV: FOETAL DIAGNOSTICS:

Prenatal molecular diagnosis: CVS and amniocentesis – preimplantation test -Medico legal, social, ethical and legal aspects of molecular diagnostics-Sex selective abortion-MTP-Medico legal aspects-Foetal diagnositics: prospects.

### UNIT V: CYTOGENETIC DIAGNOSITICS

Karyotyping and chromosomal banding– Molecular diagnosis of syndromes - Klinfelter, Downs' and Turners'- Molecular cytogenetics: FISH, Fiber FISH and m–FISH-Clinical applications.

### REFERENCES:


1. Strachan, T. and A.P. Read. 2004. Human Molecular Genetics. 3rd Edition. Garland Science, UK.

2. A Practical Guide to Clinical Virology. 2nd Ed. L.R. Haaheim., J.R. Pattison. R.J.Whitley. John Wiley &Sons, 1994.

3. Biomedical Methods Hand Book– John M. Walkser, Ralph Raplay. Humana Press, 2005.

## PAPER – III: ENVIRONMENTAL FORENSICS

**UNIT- I**

Principles of Forensics Biology Scope of Forensic biology Branches of forentic Biology component of environmental forensics – setting of forentic lab – Applications – Enforcement agencies public and private – Natural Institute of Criminology and Forensic Science.

**UNIT: II**

Environmental factors of forentics – crime scene- infects- maggots- larval stage analysis- level of decay and deterioration- forensic evidence – Food poison as evidence – Forentic entomology.

**UNIT: III**

Forensic serology-blood clots-blood stains- blood stained cloths- environmental components Injuries – wounds etc., serological assays-blood groups – molecular markers-forensic evidence – Post mortem changes – case studies.

**UNIT: IV**

Toxicity assessment- poisons- methods of analysis- forensic applications –Food positions – water contamination: testing methods – Analysis for potability at poisons.

**UNIT: V**

DNA Evidence –methods of DNA extraction – storage – PC, RT-PCR etc., - RFLP & RAPD etc., - DNA data base – Data analysis methods – disputed paternity - Application.

**REFERENCES:**


1. Forensic Medicine (1979). Simpson, K. ELBS ($8^{th}$ Edition).
2. Criminalistics, an introduction to forensic sciences: (1978). Safertein, R. Frentice Hall of India, New Delhi.
3. An Introduction to Forensic DNA Analysis (2002). Rudin, N and Crim, K. I.C. CRC Press, New York.

## PAPER-IV: MOLECULAR EPIDEMOLOGY

**UNIT: I**

Overview and introduction – Definition – Targets of molecular epidemiology – Environmental perspectives - Bacterial Pathogens – Transmission and Dissemination – Bacterial Infections –Diphtheria-Anthrax – Neisseria – Detection Methods

**UNIT: II**

History and geography of TB and Leprosy – Epidemiology of Mycobacterium TB in lepta – HIV- TB co infection Co Infection – Transmission Process - Host factors - – Detection methods –Serological and Molecular method – Tropical diseases (TDR).

**UNIT: III**

History of Geography of parasitic diseases - Parasite infections –Malaria – Leshmaniasis – Trypanosomiasis – Transmission mode –Methods of Detection – Vectors – Indian status – Global scenario

**UNIT: IV**

History and Geography of warm infections; Tapeworms - Schistosomiasis – Filariasis – Vectors and Modes of Transmission –Diagnosis and Detection – Indian status – Global scenario.

**UNIT: V**

Tools in molecular epidemiology – PCR – RAPD -PCR-RTPCR-PFGE-16sRNA-16s DNA analysis-Microarray based screening – multilocus enzyme typing (MLET) and multilocus sequence typing (MLST).

**REFERENCES:**


4. Dominique A. Cangant. Molecular Epidemiology of Microorganisms; methods and protocol; Human press. 2009.

5. Walker, T.S. (1978). Microbiology. W.B. Saunders Co., USA,

## PAPER – V: PRACTICAL - I MOLECULAR DIAGNOSTICS - I

1. Human Genomic DNA Extraction from Blood
2. Bacterial DNA extraction.
3. Viral DNA /RNA Extraction ( Kit)
4. Serodiagnostics for microbial & viral pathogens.
5. HIV detection by RT-PCR (Demo).
6. PCR diagnosis of Mycobacterium tuberculosis.
7. PCR–RFLP for pathogens.

## PAPER – VI: PRACTICAL - II MOLECULAR DIAGNOSTICS -II

1. DNA extraction from soil
2. DNA extraction from buccal wash
3. mRNA extraction and cDNA synthesis
4. Fingerprinting for leptospiral pathogen.
5. Western blotting.
6. Southern blotting - demo
7. Immunoflouresecnt Technique for cancer marker